

SCIENCE.

FRIDAY, SEPTEMBER 14, 1883.

THE U. S. SIGNAL-SERVICE.

I.

THE annual report of the chief signal-officer for 1881, recently issued, is a volume which ought to be of great interest to all concerned in the progress of meteorological science in this country; and it would be, were it not for certain characteristics too apt to be found in government publications. Of these, the most notable at first sight is its ponderous bulk. After one has received the polite notice, 'a package too large for the carrier,' etc., and has achieved its safe delivery in one way or another, he is likely to wonder what end it may be best made to serve. If he be interested in meteorology, he will find it well worth his while to give at least one volume of the series a careful examination, in order that he may know what not to read in the next.

In its thirteen hundred broad pages, together with its maps, charts, etc., he will find much that is valuable; much that, to him, is perfectly useless; and, if his tastes be not too circumscribed, much that is amusing. A government report is not a likely place in which to seek entertainment; but, considered as a scientific publication, the report will furnish its share. In this respect it is, doubtless, clear ahead of all other scientific documents issued by the government.

As a scientific document it must be considered; for, since the organization of the weather bureau of the signal-service, by far the larger part of the operations of that service have had to do with meteorology; in fact, the work in the way of practical meteorology constitutes the only *raison d'être* of the service as at present organized and equipped.

A fair examination of this work can only be made by a comparison of this report with those of the several preceding years: indeed, justice could not be done the present administration

without such a comparison, as it indicates changes of considerable moment, which seem likely to greatly increase the efficiency and value of the service.

The first part of the volume consists of the report proper of the chief signal-officer. This seems, in each case, to be made up almost entirely by copying from the report of the previous year. It must have been written, of course, at some time, and by somebody; but when and by whom will soon be lost to the history of meteorological science. A few additions are made, fewer subtractions, and now and then a linguistic blunder has been eradicated, after it has done faithful service for several years. The impression is everywhere conveyed, that the preparation of this, which one might expect to find the freshest and most readable portion of the volume, is annually committed to the skill of a copying-clerk. It is not to be denied, that certain statements in regard to the service will bear, and deserve, repetition; and, indeed, the chief signal-officer himself inserted a sort of an apology for this repetition a few years ago, which has been faithfully reprinted along with the rest ever since. But whole pages are repeated year after year, when it would appear that they had served their purpose in a single publication; and this seems all the more uncalled-for in the case of much which might better have never been published at all.

We are annually informed, that "meagre reports only have been received of the instruction for the field duties of the signal-service elsewhere than at Fort Myer;" and we wonder why whoever is responsible for this neglect is not urged to remedy it, through some other avenue than the annual report. The need of a fire-engine at the post was a standing item for several years; but, as it does not appear in the last report, it may be assumed that the want has been supplied, possibly through the generosity of some distressed reader.

The space occupied by the fire-engine is now filled, however, by the extraordinary and interesting announcement, that "the post-garden is in good condition, and has, for some time, been a source of supply to the company mess." The importance of this statement entirely overshadows that of many others which might be quoted, — such as that the enlisted men have succeeded in managing the coal-oil lamps which have been supplied them, that the buildings of the post will require painting the coming season, etc.

In some instances the annual reprint has not received that attention which might be expected even from clerical supervision. One of the statements which has regularly made its appearance for several years is this: "It is needless, with such facts in view, and after — years of continuous service, to reiterate the advantages secured to the signal service by its military organization." In spite of this declaration, the reiteration has been religiously kept up; and it was evidently intended that the above blank should be properly filled as the years rolled by. In the report for 1879, it is filled with the word 'nineteen,' and this is exactly copied in that for 1880. In the report for 1881, the word 'twenty' is substituted; so that, unless an effort is made to 'catch up' in the next report, the corps will be deprived of one 'year of continuous service,' and the argument will be proportionately weakened.

Illustrations of useless and careless reprinting might be continued to almost any extent; but it will be of greater interest to pass to Appendix I., which contains the courses of instruction furnished at Fort Myer for the training of officers and men belonging to the service.

If this is to be considered as a school for the education of meteorological observers, its curriculum is certainly marvellous. Although certain portions of the course of study are given in the report in great detail, — even to the paragraph and page at which each lesson begins and ends, other portions are not so well defined; and some assumptions must be

made as to the time occupied in certain parts of the work. It is thought that no injustice is done in the following estimate of the distribution of study and practice: —

Officers who are assigned to the school for instruction in the duties of the service remain there about one year. The instruction is theoretical and practical. In the theoretical course, about 37 per cent of the whole time is spent in the study of meteorology and meteorological observations. In the practical course, 8 per cent is a high estimate for the time devoted to that subject. Indeed, out of the year's work, it is prescribed that *eight days* shall be spent in the meteorological observatory; in which time the officer is expected to learn "the use of all instruments used at observation offices of the signal-service, care of and repair of same, and making out of meteorological forms." The remainder of the year is devoted to the study and practice of military signalling, wand-practice, military surveying, electric telegraph, international signals, etc. It is fair to add, however, that for officers who are assigned to the headquarters of the chief signal-officer, and are candidates for service in the 'indication-room,' a very liberal course of advanced study and reading in meteorology is prescribed to be carried on at the office of the weather-bureau accompanied by practice in the preparation of charts and in 'forecasting.'

The enlisted men, however, upon whom falls the burden of collecting the great mass of meteorological material, which is daily digested in the central office, do not fare so well. The period of their stay at Fort Myer is limited to about six months, during the first two of which they cannot be placed under class instruction, but are required to recite in cavalry tactics, to attend wand and telegraph practice, to stand guard, and attend to other military duties. When, at last, they are permitted to begin the study of meteorology, the percentage of their time given to it is not noticeably greater than that of the officers. During their six months at the fort, ten days are spent in the meteorological observatory; and in that time

they are expected to learn, and probably do learn, all that the officers acquire in the eight days which is allowed them for practice in meteorology. When it is remembered that the sole occupation of the great majority of these men, during the entire period of their enlistment after leaving Fort Myer, is to make and record meteorological observations, it seems little short of folly to subject them to such a course of training in preparation. That only ten days, out of the one hundred and eighty spent in the school, should be occupied in practical training in observation, and the use of instruments, is certainly an inversion of the true order of things. It is difficult to see the value, to such men, of the long training in 'cavalry tactics,' the 'manual of the carbine,' the 'manual of the kit,'—whatever that may be,—and many other things found in the course. It is true, that, to observers stationed on the seacoast, a knowledge of naval signals is necessary; and, to all, a degree of familiarity with the practical working of the electric telegraph would be desirable: but the business of the great majority of the observers is purely scientific, and, it is to be hoped, peaceful in its character. It is clear that the skill and knowledge necessary to the successful performance of these duties must be largely acquired after active service has begun.

The chief signal-officer very properly remarks, that the criticism to which the service has been subjected is evidence of its success. No well-informed person can fail to feel great pride in the results achieved by the signal-service since the organization of the weather-bureau. The general increase in the accuracy of its forecasts, the efforts made to communicate important meteorological information to localities likely to be seriously affected by probable changes in the weather, and its valuable services in the display of cautionary and danger signals, have given it a hold upon the confidence of the people not easily weakened.

The percentages of verification of predictions since the organization of the weather-service, as given in the various reports, are as follows:

Year.	Per cent of verification.	Year.	Per cent of verification.
1871	69	1877	86
1872	77	1878	84
1873	77	1879	86
1874	84	1880	86
1875	87	1881	85
1876	-		

In the display of cautionary and danger signals, the success has been about equally great. In forecasting, in which the character of the weather only is considered, the percentage of verification is generally as high as ninety.

While these figures do not indicate any marked progress during the past five years, it must be remembered that a point has been reached from which farther advance must necessarily be difficult and slow.

'*REX MAGNUS*.'

At the suggestion of the editors of SCIENCE, I have carefully examined the 'viandine' brand of the new preservative '*Rex magnus*,' and find it contains boracic acid, sodium, potassium, and water as ingredients; and I believe its composition can be roughly formulated as follows:—

Boracic acid {	
Borax {	67 per cent.
Potassic chloride	15 "
Water	18 "

The mixture also contains very small amounts of sulphur and magnesium. Both, however, are probably accidental impurities.

To determine the preservative properties of the viandine brand, a number of experiments were undertaken, the general result of which can best be shown by copying some of the notes taken during the course of the experiments, and supplementing them with a formulated table.

July 5, I dissolved one-half pound of viandine in one gallon of water contained in a stone jar, and placed one pound of beef-steak, one pound of veal-steak, and one pound of fresh mackerel in the solution.

July 6, the beef, veal, and fish, which had remained in the solution twenty-six hours, were removed, and, after allowing them to drain for two or three minutes, were placed on plates in the laboratory.

July 7, I boiled the solution which had been used with the meats and fish, and removed the scum that rose to the surface. When cold, I added about two ounces of viandine, and poured the solution into a stone jar containing one pound of mutton-chops and one pound of liver.

Tabular statement of experiments with 'Rex magnus.'

July.	Temper- ature.	Beef-steak.	Veal.	Mackerel.	Liver.	Mutton-chops.	Roasting piece of beef.	Leg of mutton.
5	86°	Placed in solu- tion.	Placed in solu- tion.	Placed in solu- tion.	- -	- -	- -	- -
6	85	Taken from solution.	Taken from solution.	Taken from solution.	- -	- -	- -	- -
7	84	No odor.	No odor.	No odor.	Placed in solu- tion.	Placed in solu- tion.	- -	- -
8	73	No odor.	No odor.	No odor.	Taken from solution.	Taken from solution.	- -	- -
9	70	No odor.	No odor.	No odor.	No odor.	No odor.	- -	- -
10	72	No odor.	No odor.	No odor.	No odor.	No odor.	- -	- -
11	71	No odor.	No odor.	No odor.	No odor.	No odor.	- -	- -
12	79	No odor.	No odor.	No odor.	No odor.	No odor.	- -	- -
13	78	No odor.	Slight odor.	No odor.	No odor.	No odor.	- -	- -
14	79	No odor.	Slight odor.	No odor.	Leathery look, slight odor.	No odor.	- -	- -
15	79	No odor.	Slight odor.	No odor.	Slight odor.	No odor.	- -	- -
16	77	No odor.	Odor.	No odor.	Slight odor.	No odor.	- -	- -
17	80	Eat a piece, palatable.	Odor.	No odor.	Odor.	No odor.	- -	- -
18	79	No odor.	Odor.	No odor.	Odor.	No odor.	Placed in solu- tion.	Placed in solu- tion.
19	73	No odor.	Odor.	No odor.	Odor.	No odor.	- -	- -
20	74	No odor.	Odor.	No odor.	Odor.	No odor.	Taken from solu- tion.	Taken from solu- tion.
21	76	No odor.	Very disagree- able.	No odor.	Thrown away.	No odor.	No odor.	No odor.
22	79	No odor.	Strong odor.	No odor.	- -	No odor.	No odor.	No odor.
23	75	No odor.	Strong odor.	No odor.	- -	No odor.	No odor.	No odor.
24	77	No odor.	Thrown away.	No odor.	- -	No odor.	No odor.	No odor.
25	76	Slight odor.	- -	No odor.	- -	Slight odor.	No odor.	No odor.
26	79	Tasted a piece, not palatable.	- -	No odor.	- -	Tasted a piece, not palatable.	Slight odor.	Slight odor.
27	77	- -	- -	No odor.	- -	- -	Cooked, did not dare to taste, odor very strong.	Odor stronger.
28	75	- -	- -	Eat a piece, palatable.	- -	- -	- -	Cooked, odor so strong I could not re- main in the room.

NOTE.—The temperature is the mean of three daily observations taken at about nine o'clock A.M. and three and ten P.M. The laboratory in which the meats were placed was well ventilated, and protected from flies and insects by wire screens. One pound of the viandine used was obtained from the office of SCIENCE, the rest by express from the Boston office of the company.

July 8, I took the mutton and liver out of the solution, allowed them to drain, and placed them on plates in the laboratory.

July 13, the plate in which the liver had been placed was nearly full of a red-colored liquid, and the liver had a hard leathery appearance. The liver and veal had both acquired a slight odor. The other meats and fish smelled sweet.

July 16, the odor of the liver and veal had become stronger than on July 13. The liver was placed on a clean plate, as the first plate was full of the red-colored liquid. The beef,

mutton, and fish still looked and smelled fresh.

July 17, I had one-half of the beef-steak which had been treated with the viandine solution on July 5 cooked for breakfast. It was tender and palatable: still, it was not like a fresh steak. There was a slight taste of borax; and there was also a want of flavor, something like what fresh beef-steak might have if it were washed with cold water before cooking. Poured a little viandine solution over the veal and liver.

July 18, a roasting piece of sirloin beef,

weighing five pounds, also a leg of mutton weighing four and one-half pounds, — being first punctured in a number of places, especially in the neighborhood of the bones, with an iron skewer, — were placed in two gallons of the viandine solution made up like the solution of July 5. The liquid was in a stone jar, and completely covered the meats.

July 20, the beef and mutton, which had remained in the viandine solution thirty-six hours, were removed, allowed to drain for two minutes, and placed on plates in the laboratory.

July 21, I was obliged to throw away the liver, the odor being very offensive. The veal had a disagreeable odor. A few mould-spots were removed, which had appeared on the steak. No odor, however, was perceptible. The mutton-chops and fish also smelled fresh. Placed steak and mutton in viandine solution for one half-hour.

July 24, it became necessary to throw away the veal. Beef-steak, mutton-chops, mackerel, roasting piece of beef, and leg of mutton appeared fresh.

July 25, the beef-steak and mutton-chops smelled slightly old.

July 26, I had the remaining half of the beef-steak which had been treated on July 5, and the mutton-chops which had been treated on July 7, cooked for dinner. No odor was noticeable; but they had a very high taste, so much so as to be unpalatable, save to a starving man. The roasting piece of beef and the leg of mutton smelled slightly. The mackerel appeared and smelled fresh.

July 27, the mackerel, which had remained in the laboratory since July 5, was cooked for breakfast. It was fresh and fairly good, like mackerel that are served at the average hotel table. There was no taste of borax. The roasting piece of beef was to be served for dinner. On cooking, a very offensive odor was given off. An examination showed a small piece near the bone that had become decayed. The rest of the beef appeared good; but pieces cut from different parts all had a strong odor of putrefaction. The mutton in the laboratory had a perceptible odor.

July 28, the mutton was cooked for dinner; but, when placed on the table, the odor was so strong that I could not remain in the room.

The results obtained from the above experiments seem to show, that pieces of meat having large surfaces in comparison to their thickness, as steaks and chops, and also small fish, can be kept a considerable length of time, although with some deterioration in taste, by

the use of the viandine brand of Rex magnus. In the case of larger pieces, such as a roasting piece of beef, or leg of mutton, having tried only two experiments, I do not care at this time to speak positively. I can, however, state, that I should have some hesitation in again allowing to be cooked in the house large pieces of beef and mutton that had been kept in a warm room for ten days after treatment with the solution of viandine.

LEONARD P. KINNICUTT.

Worcester free institute, July 28, 1883.

THE IGLOO OF THE INNUIT.¹—V.

As the spring wears on, and thawing weather comes, the igloo falls into a decline; and when an exposed place can be found to pitch the seal-skin tent, it is abandoned. Before this can be found, however, the igloo assumes a new combination phase, which must be described. When several igloos have fallen in and buried their contents (the women, babies, and puppies managing to wriggle out, and a good share of the things being lost in the *débris* of snow-banks), the Innuits cease to build any thing more than the walls of snow, using the prospective tent for a roof; this being the same as the autumn igloo, excepting the body, which is of snow, and not of ice. This phase of the igloo is so well shown in the illustration on the next page, taken from the German book of a member of my party, Mr. Klutschak, entitled '*Als Eskimo unter den Eskimos*,' that I transfer it to this article. His sketch of our spring igloos was taken on Cape Herschel, King William's Land, on the 16th of June, 1879, — the day before we abandoned them for the summer, and moved into tents.

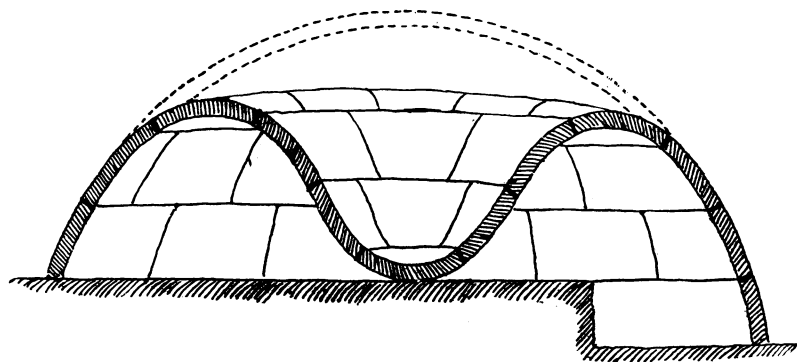
The tenacity of some igloos, however, before they tumble in, is truly wonderful. They always give ample warning by slowly sinking on the top and side towards the sun or warm wind; and this the inhabitants counteract by thrusting a pole from the inside through the dome at its most threatening point, and there firmly lashing several small cross-pieces to prevent further sinking, which it will do if not too warm, or some small dog with bone in mouth, and pursued by a larger, does not take refuge on top, as is their wont, — when the snow-dome, dogs and all, come tumbling in on the heads of the hyperboreans. The foot of this pole rests on the floor, hardened by tramping, or a board is put under it to give it support. I have, however, seen a high-domed, abandoned

¹ Concluded from No. 31.



LIEUT. SCHWATKA'S PARTY, ENCAMPED IN SPRING IGLOOS, IN KING WILLIAM'S LAND, JUNE 16, 1879.

igloo, which had been well chinked and lightly banked (the whole mass nearly homogeneous from long use), slowly subsided from the top until this touched the floor, and so remain without tumbling in, the igloo being actually inverted in its upper half or two-thirds. Here



it would remain for a few days before warm weather would cause it to fall to pieces. I have tried to show a cross-section through such an igloo, the broken line showing its original position.

When food is readily procured without much effort, as in seasons of great plenty, the natives do not wholly abandon the necessary exercise to keep them in good muscle and bodily health, as is the general opinion respecting these people, but have been known to keep it up by various gymnastic devices, one of which (tight-ropes made of thongs of walrus-hide neatly and strongly lashed within an empty igloo) is well portrayed by Capt. Hall in the illustration.

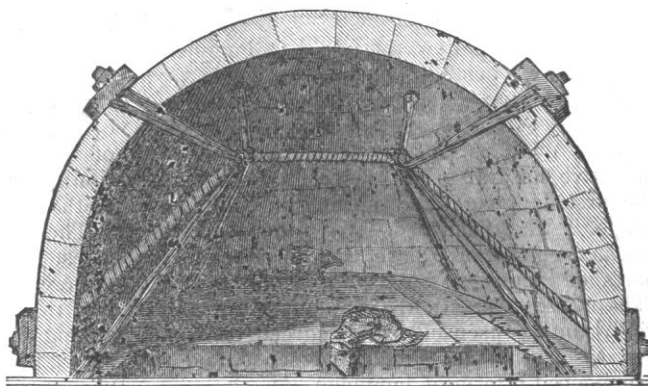
I should like to give a few brief descriptions of those appurtenances that might be strictly called igloo accessories, as the native stone lamp and kettle, the well to fresh water through the thick ice, beside the snow-hut and many other minor items all growing out of the igloo itself; but this article has already grown to such dimensions that they must be laid aside.

The utility of the igloo cannot be exaggerated. Habituated as my little party of white men were, during our two winters in these desolate zones, to a constant life in these simple habitations, and the many comforts accruing therefrom, I have often marvelled how white men could stand the hardships and

privations of a spring tent-life in the many expeditions wherein they were used, and under circumstances that would have been absolute pleasure to my party. I have read so often of their sufferings while journeying in tents, and the discomforts and even dangers they risked

while living in ships and other unsuitable arctic abodes, during short journeys from these places, under such intensely low temperatures as -50° , -60° , or even -70° F., when under almost the same conditions my party was prosecuting a comfortable sledge-journey four hundred to five hundred miles from its base of supplies,

with no provisos except such game as was killed from day to day, that the conviction becomes two-edged that the accessories of igloos, and their constant companion of the cold, the reindeer clothing, are absolutely essential to a well-managed arctic sledge-journey. With their help, strange as it may seem, the subject of temperature becomes entirely of secondary importance, if it enters the arctic travelling problem at all; and, were it not for the long dark night which accompanies these thermometrical depressions, I



INNUIT TIGHT-ROPE.

believe that a protracted sledge-journey could be carried successfully forward in the continuous cold of the lowest recorded temperature, all other things being favorable.

FREDERICK SCHWATKA,
Lieut. U. S. Army.

A UNIVERSAL LANGUAGE AND ITS VEHICLE,—A UNIVERSAL ALPHABET.

SHALL the world ever see an end of the confusion of tongues? Shall differences of language cease? Or shall, at least, some selected medium of thought be established throughout the world, by which all men may understand each other on occasion, while still preserving their vernaculars for intercourse at home? A consideration of the subject may enable us to answer these questions.

Language in all its varieties is a growth; and every living language is still growing, shedding leaves here, and pushing out new leaflets there, according to its vigor of vitality. The most copious language of to-day was smaller yesterday, and smaller still in every generation through which we can trace its history. We cannot go back to its beginning, for it properly had none: it did not spring from a seed, and so take the definite form of a parent language; but each tongue arose from the crossing and interlocking and blending of shoots from older languages, until they grew together, and became a new stem, from which, in turn, shot other branches, to repeat the process to the end of time.

In the comparative study of languages, and in what we know of human history, we can trace the evidences of this continuous cross-grafting of branch on branch in various directions; and the oldest tongues are those to which some peculiar form of growth can be traced back and back through the greatest number of stages.

If we could follow these oldest languages up to their respective sources, we should find at last a very small vocabulary of simple utterances used to denote an extremely limited number of ideas. But we should find no primitive natural germ of speech from which the first language had sprung into life and shape. The faculty of *expression*, and the instinct of *imitation*, are the only primitive parts of language; but these, at first, were, like primitive creation, 'without form, and void,' until consenting minds agreed on some few associations of sound and sense, and so commenced a form of language.

Any number of different forms may have been thus commenced by isolated families or groups of men. Individual members of different families or groups would occasionally come together, and each would enlarge the other's vocabulary, or modify his methods of expression. Thus one may have previously used only a dual number to indicate plurality;

another, only an indefinite plural: but mutual intercourse would incorporate, in the common language that would be developed, both of these methods of expressing and defining the idea of plurality. Primitive languages may thus have acquired from each other the many words and forms of speech which they possessed in common; while their independent characteristics would increase in the absence of association.

On the same principle, a closer intercourse between modern nations must have an amalgamating effect on their languages, and so tend to produce an ultimate unification of human speech. This closer intercourse is being accomplished in our days by railroads and steamships; and strange ears in all quarters of the world are being familiarized with the languages of visitors and immigrants. The interests of commerce, and the influence of example and of social feeling, lead to a more and more general acquisition of the languages thus introduced; so that, without displacing local forms of speech, other media of wider intercommunication are being gradually extended everywhere. A universal language *is thus growing up*. Whether it will ultimately take the lines of English, French, German, or some other tongue, will depend on the relative fitness of the competing languages for universality. At all events, the fittest will survive, and the survivor will gradually occupy the whole field.

The present diffusion of English over the continents of America and Australia, and among sailors of all nations; its growing acceptance throughout the continental countries of Europe; its establishment in many nuclei in Asia and Africa, and over the vast empire of India, as well as the grammatical simplicity of the language, and its power of incorporation of foreign elements,—all point to English as the probable universal tongue of the future.

The only alternative to such adoption of the fittest among existing languages would be the creation of a new form of scientific speech; but this would require a universal consent among nations, and a combined effort, that may fairly be considered impossible as preliminaries to the institution of such a language. The creation of a new form of speech adapted for universal use is certainly within the power of science and invention to accomplish; but the aid of a pre-existing language, all but universal, would be required for its introduction and establishment. In the far future, such a form of scientific speech may find the world prepared for it, and the medium for its

diffusion in sufficiently general use: but, in the mean time, the confusion of tongues is being gradually reduced by the struggle for supremacy among established languages; and this process will go on until one tongue shall be intelligible, if not predominant, everywhere.

All languages have their physical material in common: they use the same vocal organs, and essentially the same elementary sounds. The voice is susceptible only of a limited number of modifications, and the lips and the tongue only of a limited number of articulative actions; and, from the combinations of these, all the varieties of human utterance result. This elementary simplicity and uniformity are not, however, reflected in the writing of languages. Alphabets are wholly arbitrary; and, although the same letters are used in many alphabets, a different value is, in nearly every case, associated with the individual letters. A universally intelligible method of representing the sounds of speech is a necessary prerequisite for a universal language. Ordinary alphabetic writing is, indeed, as much a hindrance to combined effort for the unification of language as was the confusion of tongues to the building of the tower of Babel. Some method of classifying and representing all known modifications of voice and articulation, if not of discovering all possible modifications, had long been the great desideratum of philologists. Attempts were made to frame a universal alphabet by collating the elements from local alphabets, ancient and modern; but the number of shades of difference discovered among the elementary sounds, and the difficulty of recognizing sounds under varied associations, rendered any complete classification impracticable. So far as the discovery of the entire category of possible sounds was concerned, the object of endeavor was considered to be hopeless; and the attempt to realize it was finally and formally abandoned at a convention of philologists of different countries, held at London in 1854. The declaration of this convention stands on record, that—

“It would be useless and impossible to attempt to find for each possible variety of sound a different graphic sign.”

This ‘impossibility’ has, however, been since accomplished with completeness and simplicity, in the system entitled ‘Visible speech,’ the principles of which will now be explained. In this system no sound is arbitrarily represented, but each letter is *built up* of symbols which denote the organic positions and actions that produce the sound. The let-

ters are thus physiological pictures, which interpret themselves to those who have learned the meaning of the elementary symbols of which they are composed.

The first letter of our ordinary alphabet, which we call *a*, is known in other countries as *ah*; but we discover, in using the letter, that it represents both *a* and *ah*, and a variety of other sounds in our own language, the letter *a* being employed for the six diverse vowels in the words *ale*, *air*, *an*, *agree*, *ah*, and *all*. In Visible speech each of these sounds has a separate letter, and each letter explains to the eye the organic means by which its sound differs from other sounds. For example:

The letter for the vowel in the word *ale* tells the reader to—

Advance the front of the tongue towards the front of the palate, so as to leave a channel of medium breadth for the passage of the voice.

The letter for the vowel in *air* tells him to—

Place the tongue in the same position as before, but to expand the back cavity of the mouth.

The letter for the vowel in *an* tells him to—

Broaden to the utmost degree the channel between the front of the tongue and the palate, and at the same time expand the back cavity of the mouth.

The letter for the sound of *a* in *agree* tells the reader to—

Place the tongue in a neutral position,—neither advanced nor retracted, raised nor depressed,—and expand the back cavity of the mouth.

The letter for the sound *ah* tells him to—

Depress the tongue backward as far as possible, and expand the back cavity as before.

The letter for the vowel in *all* tells him to—

*Place the tongue in the same position as for *ah*, but compress the back cavity, and round the corners of the lips.*

All these directions are perfectly conveyed at a glance in the different letters; and yet the letters, so far from being complex, consist of forms more simple than the letters of the Roman alphabet. Here, for example, are the symbols,—four in number,—from the combinations of which, not merely the sounds above illustrated, but every vowel in every language, can be expressed to the eye, so as to be at once pronounced with exactitude by the reader.

ELEMENTARY SYMBOLS OF VOWELS.

| + • a

These symbols have the following invariable meanings:—

1. The straight line means *voice*.
2. The bar across the line means contraction or rounding of the *lips*.
3. The solid point means *compression* of the back cavity of the mouth.
4. The open hook means *expansion* of the back cavity of the mouth.

The position of the point or hook on the straight line denotes the position of the tongue in reference to the palate. Thus:—

a. When on the right side, the meaning is, that the tongue is advanced towards the *front* of the palate.

b. When on the left side, that the tongue is retracted towards the *back* of the mouth.

c. When on both sides, that the tongue occupies a *middle* position between front and back.

d. When at the top of the line, that the tongue is *raised* towards the palate.

e. When at the bottom, that the tongue is *depressed*.

f. When at both ends, that the tongue occupies a *middle* position between high and low.

Nothing could be simpler than these elements, the meanings of which are remembered by every person after a single explanation; yet from these four elements alone the entire series of normal vowels, thirty-six in number, are built up. Two diacritic signs extend the possible number of shades of vowel-sound, which these four elements can be made to represent, to the largely superfluous total of one hundred and eighty.

The English alphabet contains only five vowel-letters, while our speech makes use of at least sixteen vowel-sounds, without including diphthongs. No wonder, therefore, that the relation between letters and sounds is one of irreconcilable confusion. A purely phonetic alphabet, in addition to the common system of letters, is a necessity for the intelligible writing of English alone; much more is it indispensable for the writing of all languages intelligibly to all readers.

The system of Visible speech is the ready vehicle for a universal language, when that shall be evolved; but it is also immediately serviceable for the conveyance of the diverse utterances of every existing language. No matter what foreign words may be written in this universal character, they will be pronounced by readers in any country with absolute uniformity. The means have been explained by which *vowels* are represented for this purpose. The principles are now to be shown on which *consonants* are written with the same effect.

ELEMENTARY SYMBOLS OF CONSONANTS.

Five elementary symbols furnish letters for all the consonant actions of the lips and tongue. These symbols are—

C ε | § ∷

As with vowels, so with consonants: all the elements of each class have one symbol in common. The vowel-symbol was shown to be a straight line: the consonant-symbol is a *curve*; and the direction in which the curve is turned denotes the part of the mouth by which the consonant is formed. Thus:—

a. The curve turned to the right denotes the *lips*.

b. The curve turned to the left denotes the *back* of the tongue.

c. The curve turned archwise, with its end down, denotes the *top* of the tongue.

d. The curve turned with its end up denotes the *point* of the tongue.

The five radical symbols have the following meanings in every combination:—

1. The first (C) is the sign of a part of the mouth used to form a *consonant*.

2. The second (ε) is the sign of a part of the mouth which *divides* the breath.

3. The third (|) is drawn across the ends of a curve to denote a consonant that *stops* the breath.

4. The fourth (§) is the sign of emission of breath through the *nose*.

5. The fifth (∷) is added to the ends of a curve to denote simultaneous modification by *two* parts of the mouth.

These elements, combined into *six* forms of letters, suffice for the whole series of consonant actions of the lips and tongue. The six forms turned in the four directions, as above, yield twenty-four letters; and the uniform addition of one sign for *voice*—a straight line in the centre of the curves—converts the twenty-four into forty-eight letters.

Every part of every letter has thus a meaning legible at a glance; and the most complex letter in the alphabet—combining four of the elementary symbols to exhibit the sound of *m*—is as simple in form as the common Roman letter for the same consonant. Thus:—

Θ M, m.

The following are the four symbols combined in this letter:—

1. A curve to the right, which denotes the *lips*.

2. A centre straight line, which denotes *voice*.

3. A waving line, which denotes *nasal* emission.

4. A line closing the curve, which denotes *stoppage* of the breath.

The letter thus says to the reader :—

Stop the breath by means of the lips, and sound the voice through the nose.

It must be obvious that such directions, conveyed without words, will be uniformly interpreted by readers of any nationality who have simply learned the meaning of the radical symbols. All the Visible-speech letters are formed in this way, by synthesis of two or more out of a total number of nine elements. Such letters, consequently, make up an alphabet adapted for universality, because independent of explanatory language; also because its symbols are physiological pictures, and because the writing, even of unheard foreign tongues, is self-explanatory to the reader's eye.

Visible speech was first published sixteen years ago (August, 1867); and it has been very generally studied by philologists, and adopted in theoretical works as a necessary exponent of linguistic phonetics. It has also been widely utilized in America for the teaching of articulation to the deaf. But its popular uses for the teaching of vernacular languages to children and illiterates, and of foreign languages in schools and colleges, as well as for the literation of hitherto unwritten Indian and other tongues, have not yet been correspondingly developed. People generally do not take the trouble to investigate the nature of the characters, but suffer themselves to be repelled by fancied difficulty,—as if what is strange must needs be difficult. But the difficulty is only to eyes unacquainted with the principles of the symbolization. When these are known, there is no comparison, in point of simplicity, between Roman letters and Visible-speech letters. To children and illiterates, all letters are equally strange. To one who can already read, the eye is simply prejudiced in favor of established letters. In the present exposition the *letters* of Visible speech have not been made the basis of illustration, but only the rudimentary symbols from which all the letters are derived. This mode of treatment will, it is hoped, leave no room for prejudice to act.

In this stage of the world's history we do not need to concern ourselves about a universal language: that will develop itself in due time. But a universal medium for the communication of languages is a practical necessity, which every day renders of more and higher importance. Without a universal alphabet there never could be a universal lan-

guage; with a universal alphabet the progress of the fittest language towards universality will be enormously accelerated. At present, English seems the most likely to achieve this distinction; but its natural fitness is antagonized by its defective and irregular system of letters. Give English the advantage of an alphabet simple and phonetically perfect, and, whereas it is now the most difficult of all tongues for foreigners to learn, it will become by far the easiest.

In the system of Visible speech a universal alphabet is for the first time attained: the system is of English birth. Let its native language have the benefit of this instrument of diffusion, and the world-wide predominance of the speech of Britain and America will be assured.

A. MELVILLE BELL.

LETTERS TO THE EDITOR.

Variations in butterflies.

BETWEEN the 20th of June and the 10th of July, I obtained three hundred and eighty *Vanessa Antiopa* from caterpillars fed on swamp willow. Twenty-five of these were varieties, and the balance were of the usual form. Two of the varieties were *Lintneri*, from which all the blue had disappeared. The third had the primaries *Lintneri*, while the secondaries had the usual blue spots. The fourth had the secondaries *Lintneri*, while the primaries bore the blue spots. In the remaining twenty-one, the whole upper surface of the wings had a mottled appearance, showing that the colors had been disturbed. They retained the blue spots, but the spots were much smaller than usual.

The veins in the twenty-five varieties remained soft for several days; not becoming firm and hard, like the veins in the others, although treated in the same manner. I have also found this softness of the veins in the varieties of *Turnus*, where the red is suffused, and in the rust-colored specimens.

All the *Vanessa Antiopa* which I have seen this season have the yellow of a much deeper shade than I have ever before noticed.

Colias Philodice is also remarkable this season in this respect.

S. LOWELL ELLIOT.

New York City, 3d August, 1883.

Function of the colorless blood-corpuscles.

The interesting abstract of Zawarykin's important investigations into the function of the leucocytes in the absorption of fats from the intestinal canal (*SCIENCE*, ii. 192) calls to mind an investigation by Franz Hofmeister, into the absorption and assimilation of the peptones, which will be of interest in connection with the abstract referred to.

In a series of papers published in 1881, Hofmeister¹ comes to the interesting conclusion, that "absorption of peptones in the intestinal canal is, accordingly, no simple mechanical process of diffusion or filtration, but is rather a function of particular living cells, the colorless blood-corpuscles; and these play, in the nutrition of the organism, a similar rôle to that of the red corpuscles in respiration."

In his discussion he calls attention to the presence

¹ *Zeitschr. phys. chem.*, v. 151,

of the leucocytes, in great numbers, in the adenoid tissue during digestion; and, also, to certain proofs of the ability of the leucocytes to combine, with peptones in a loose form of combination.

The similarity of these two functions of the colorless corpuscles, as determined by Hofmeister for peptones, and by Zawarykin for fats, cannot fail to suggest the probability of a very definite and important function of these corpuscles in general nutrition. Possibly, also, the anomalies observed in the absorption of saccharine food, and in the glycogenic functions of liver and muscles, may in time receive some explanation through the functions of the colorless corpuscles.

It seems as if we were, at last, beginning to obtain an idea of the functions performed by these important cells, whose close connection with the life of the organization has been generally recognized, though but vaguely understood. J. M. S.

HUMAN PROPORTION.

Human proportion in art and anthropometry: a lecture delivered at the National museum, Washington, D. C.

By ROBERT FLETCHER, M. R. C. S. E. Cambridge, King, 1883. 37 p. illustr. 8°.

FROM the earliest ages, man has found his standards of measurement most conveniently in some bodily measure, like the digit, the palm, the span, the foot, or the cubit. As these measures necessarily vary with the size of the individual, the attempt to ascertain their average led to the first systematic measurements of the human body: hence have sprung the innumerable schemes of human proportion devised by artists and anatomists, all founded on the belief that some one part of the body was a standard of measurement for all its other dimensions. The Egyptians first developed a canon of proportion as early as the thirty-fifth century B.C., which was twice subsequently changed. Their last canon adopted the length of the middle finger as the standard, reckoning it precisely one-nineteenth of the entire stature. But in the 'canon of Polykleitos,' the famous sculptor who flourished about 450 B.C., was embodied the highest rule of Greek art in its most flourishing period. This has fortunately been preserved in a well-known passage of Vitruvius, and is illustrated by a recently discovered drawing by Lionardo da Vinci. The restless spirit of modern life has not remained content with this, as more than a hundred different attempts bear witness by men of all nations, including the celebrated English sculptor Gibson and our own Story. All these methods have been based upon the theory that there is a fixed relation between some one portion of the body and all its other dimensions; and their number proves the fallacy of the idea. Anthropometry, on the other hand, measures

with the strictest scientific accuracy the living man, and from an immense mass of measurements obtains the mean of the human form, and thus arrives at the perfect human type. The father of this science is the Belgian Quelet, and the enormous number of measurements rendered necessary by the draft during our civil war have greatly advanced it. By its tests many a time-honored dogma bearing upon human proportion has been exploded. Thus it has been proved that the length of the outstretched arms is somewhat greater than, and not exactly equal to, the height of the body; that not eight, but seven and a half heads make up the entire stature; and that only in the negro skeleton can be found the length of humerus bestowed upon the Apollo Belvedere.

All these matters the author has illustrated with great learning and in a clear and animated style. We have noticed, however, that his knowledge of archeology is sometimes at fault,—as where he calls the '*crux ansata*' in the hand of the Egyptian standard figure 'a key,' which is really a cross with a loop or handle attached to it, and is the symbol of eternity; or suggests that the 'golden fleece' was in reality 'the secret of Egyptian art;' or states that the Doryphoros of Polykleitos was 'a beautiful youth in the act of throwing a spear,' instead of its being one of the 'spear-bearers,' the body-guard of the Persian king. The most marvellous statement, however, is, that "prior to the time of Phidias, the face, hands, feet, or other exposed parts of the body were carved in marble, and fastened to a wooden block, which was covered with real drapery." This is a complete misunderstanding of the nature of the archaic *éōava*, or wooden statues, which in Greece preceded those made of stone or metal.

WARE'S MODERN PERSPECTIVE.

Modern perspective: a treatise upon the principles and practice of plane and cylindrical perspective.

By WILLIAM R. WARE, Professor of architecture in the School of mines, Columbia college. Boston, James R. Osgood & Co., 1883. 321 p. 12°.

PROFESSOR WARE'S *Modern perspective* is in substance a series of papers printed two or three years ago in the *American architect*, but with additions which extend its range, and give it more the scope of a scientific treatise. Scientific it is, both in its idea and its methods; though its treatment is naturally freer than would be given it for scientific uses alone,—freer, perhaps, than the author would have given if it had originally been written as a formal

treatise. The purely geometrical method comes out most clearly in the chapters added in the revision, particularly in two (xvii., xviii.), in which, after going over the ground of practical perspective, Professor Ware sums up, first the principles and relations, and then the chief problems, in the most abstract and generalized form. This portion is, therefore, scientifically the essence of the book, and is that which a reader versed in pure mathematics, but unacquainted with perspective, might properly read first. Such a reader would find pleasure in its neatness and comprehensiveness of statement, and in the skilful way in which the whole subject is cast in condensed and logical form; every phenomenon or process being first presented in its most general aspect, — against the usual habit of books on perspective, — and particular cases deduced from it afterwards. These chapters make a sort of inner treatise, whose appeal will be to the geometer and the special student. They are probably too abstract and too concise to be acceptable to the ordinary student, and he may be left to skip them.

The methods of the book are naturally those of descriptive geometry. We could wish Professor Ware had held to the received terminology when he names the perspective of the vanishing-line of a plane its 'trace,' and diverts the word from its received sense as the intersection of the plane with the plane of projection. What in descriptive geometry is called the trace, Mr. Ware calls the 'initial line' of the plane: the point where a line pierces the picture-plane, which might by proper analogy be called the *trace* of the line, he calls its 'initial point.' The use of 'horizon' for the actual vanishing-line of any system of planes is happier. The subscript notation employed is the author's own, and is cleverly contrived to suit the manner of his exposition. It contains in itself a symmetrical record of the principal data and relations, and its neatness and efficiency make one the more regret that the author has not cared to follow an accepted terminology where there is one.

The phenomena of planes in perspective are first discussed, according to the author's uniformly analytical method: first oblique planes, then parallel and normal. So much of the perspective phenomena of lines is accounted for by treating them as intersections of planes, that their separate consideration is much shortened by anticipation; and by the time the point is reached, its discussion is reduced to a minimum. In like manner, instead of confining the discussion of points of distance, as is

common, to points in the horizon-line, or the prime vertical, the most general case is first considered, and the circular locus of all the points of distance of a given line is determined. We miss the categorical statement, — implied, to be sure, but worth making distinctly; — that the points of distance are the same for all parallel lines; as in another place it is apparently taken to go without saying, that the vanishing-point of a line, or the vanishing-line of a plane, is enough to determine problems relating to its direction, even when its position is unknown. The chapter of abstract problems presents pretty much all the problems of descriptive geometry, so far as concerns planes and right lines, applied in perspective, and therefore covers, except for a few special cases, all the elements of perspective practice. Here, again, generalization and condensation are carried very far: some, indeed, of the problems in which many alternatives are grouped together are perhaps too succinct and comprehensive to be satisfying to the student.

The same method and quality are found in the other chapters of the book, so far as suits with its practical purpose. Thus parallel perspective, usually taken first, is postponed, and treated as a special case. There is throughout a watchful eye to the needs of the architectural draughtsman and the painter. The work is made interesting by observation of natural and pictorial phenomena, many of which are, so far as we know, new to the books. Some special topics which are taken up in the advanced treatises are here hardly mentioned, — the perspective of curved surfaces and of solids of revolution, for instance; even vaulting being left untouched, and the problems not going beyond plane figures and solids with plane faces. But within its limits, the discussion is very complete; and some subjects are enlarged upon which it is usual to dismiss with slight mention, — the perspective of reflections, and of shadows by both parallel and divergent light, and especially the chapters on the perspective of the circle, and on perspective distortions and corrections. The method of the perspective plan is made much of, as it deserves; and some space is given to M. Adhémar's ingenious devices for avoiding remote vanishing-points, and carrying on all the operations on a small sheet by means of what Mr. Ware calls 'small-scale data,' — points of fractional distance, scales of depth, marginal co-ordinates, and the like, — a method which is much less known than it deserves to be. Mr. Ware adds an ingenious alternative for M. Adhémar's device of enlarging the remote parts of the perspective

plan by planes of successively steeper inclination.

The plates which accompany the book are as thoughtfully and ingeniously composed as the text. We commend the whole treatise as the most complete, so far as we know, and the most interesting and instructive for practical use, that has been published in this country.

SEEBOHM'S VILLAGE COMMUNITY.

The English village community, examined in its relations to the manorial and tribal systems, and to the common or open field system of husbandry: an essay in economic history. By FREDERIC SEEBOHM. London, Longmans, Green, & Co., 1883. 464 p., 13 maps and plates. 8°.

It is now many years since G. L. von Maurer wrote his Introduction to the history of marks and manors. Since then the subject has attracted many students, and has been much looked into and talked about. Many books have been written upon it; those of Nasse, de Laveleye, and Maine being the best known to American readers. The impression conveyed by these writings is, that the mark or village community, though almost always found upon a manor, under manorial overlordship, was in its origin independent. Manorial overlordship arose, we are told, in later times. The village community was drawn under it, and became subject to it. It has been the work of modern times to restore it to its ancient independence. This is the theory of von Maurer and his followers, which we have gathered from their books. Objections to this theory are from time to time raised. It is urged that the village community is usually found under manorial landlordship; that it is, therefore, an open question whether the village community, or the landlordship over it, is the earlier institution. In Mr. Seebohm's book, which now lies before us, it is maintained that landlordship is more ancient than the village community, that the village community arose under landlordship, as a community of slaves or serfs, that it has been slowly emancipated from slavery and from serfdom in the course of centuries. Our economic history, we are told, begins with the serfdom of the masses under manorial landlordship. Looking through the records, back to the earliest period, we find no free village communities, only manors with village communities in villenage upon them. The argument upon this point is almost conclusive. The existence of a manorial system during the Saxon period of our history is established beyond doubt.

But there were parts of Britain which were not manorial, where village communities (the village community being considered a part of the manor) did not exist. What was there in the parts of Britain where there were no manors? By the side of the manorial system was a tribal system more ancient, perhaps, than the manorial system. Then follows an account of the tribal system of the Welsh and Irish, which is extremely interesting. It is not clear at first, why, in a work upon English economic history, so much space should be given to the institutions of the Welsh and Irish; but we find out directly: it is that we may the more clearly understand the statements of Caesar and Tacitus regarding the Germans. It is well known that the statements of Caesar and Tacitus are very vague; that they become intelligible only in the light of extraneous evidence. We ourselves should not have presumed to draw this evidence from the Welsh laws, nor from the Brehon tracts. It has always seemed to us best to keep the records of different peoples quite distinct. We should, therefore, have turned from Caesar and Tacitus to the German folk-laws, formulae, and documents. The tribal system of the Germans is very well described in the German records. It happens, however, that the tribal system of the Germans resembles very closely that of the Welsh and Irish: so, though we do not follow all the steps of Mr. Seebohm's argument, we come, at last, to very nearly the same conclusion. What we have in the time of Caesar and Tacitus, and afterwards in many places where the manorial system has not been developed, are tribal households (to use Mr. Seebohm's phrase),—isolated farmsteads, occupied by groups of descendants and heirs; the land being held by them as an undivided inheritance for two or three generations, and then divided, several households arising where there was but one before. Mr. Seebohm finds a vestige of this system in the custom of Gavelkind in Kent, where we have divisions among male heirs, with traces of the right of the youngest to the original homestead. Almost everywhere else in England the tribal system has quite passed away.

Already, however, in the time of Tacitus, the manorial system was germinating. The free tribesmen who lived in the tribal households here and there—*ut fons ut campus ut nemus placuit*—had slaves who cultivated the land for them. These slaves were distributed by the tribesmen in village communities, in regard to which they were very much in the position of the later manorial

lords. It was only a step, indeed, from this condition of things to the manorial system. This step was taken immediately after the permanent settlement of the Germans within the limits of the Roman empire. The land system of the later empire was very much like a manorial system. So it happened, that, while the Germans were approaching this system on the one hand, the Romans were approaching it on the other. They reached it together.

This is the briefest possible *résumé* of Mr. Seeböhm's extremely interesting and valuable book. The argument is well arranged and very convincing. It is, perhaps, a little too much encumbered by details; but we should be sorry not to have these details, and the book is quite readable in spite of them. The account of the manorial system is the most complete that we have. The book is a mine of information upon the subject. It will be found indispensable to students. It is very well printed, and illustrated by plates and maps. It would be worth having for these alone. In conclusion, we must heartily congratulate the writer upon the completion of so excellent and useful a work.

STEARNS AND COUES' NEW-ENGLAND BIRD-LIFE.

New-England bird-life; being a manual of New-England ornithology. Revised and edited from the manuscript of Winfrid A. Stearns, by Dr. Elliott Coues. Boston, Lee & Shepard, 1881, 1883. 324+409 p. Illustr. 8°.

UNDER this title Mr. Winfrid A. Stearns and Dr. Elliott Coues have just produced an excellent and much-needed work. Previous to its appearance we have had no complete or satisfactory exposition of the subject, despite several attempts on the part of inexperienced or otherwise incompetent authors to cover the interesting field: hence the present book is doubly welcome.

It has appeared in two volumes, or parts. Part i., issued two years ago, begins with Turdidae, or thrushes, and carries the subject through Oscines, ending with the family Corvidae. In addition to the 270 pages occupied by its main portion, there is an 'Introduction' of fifty pages, which includes useful chapters on the classification and structure of birds; the 'Preparation of specimens for study'; the 'Subject of faunal areas'; and the 'Literature of New-England ornithology.' Including those devoted to its special index

as well as to the introduction, part i. contains 324 pages.

Part ii. was published early in the present year. It has in all 409 pages, of which ten are occupied by an 'editor's preface,' and eight by the index; the remaining 397 pages treating the general subject from Tyrannidae through the successive families to Alcidae, last and lowest in the scale of New-England bird-life. Both volumes are rather copiously illustrated with fairly good woodcuts; some of which are full-length figures, others representations of the heads, feet, wings, etc., of birds, designed to show technical or distinguishing characters. Most of these cuts have done similar duty before, but on this account they are none the less useful in the present connection.

The plan of the book is so clearly and tersely outlined in the preface to part i., that we cannot do better than give it in the editor's own words:—

"It is the object of the present volume to go carefully over the whole ground, and to present, in concise and convenient form, an epitome of the bird-life of New England. The claims of each species to be considered a member of the New-England fauna are critically examined, and not one is admitted upon insufficient evidence of its occurrence within this area; the design being to give a thoroughly reliable list of the birds, with an account of the leading facts in the life-history of each species. The plan of the work includes brief descriptions of the birds themselves, enabling one to identify any specimen he may have in hand; the local distribution, migration, and relative abundance of every species; together with as much general information respecting their habits as can conveniently be brought within the compass of a hand-book of New-England ornithology."

This plan is consistently and faithfully carried out. The descriptions of the birds, to be sure, are a little meagre and unsatisfactory at times; but it must be remembered that they are intended primarily for a class of amateurs who are not fitted, either by experience or inclination, to wade through more exact, technical diagnoses.

The biographical matter is written in the editor's well-known and eminently characteristic style,—a style not wholly free from faults perhaps, but, in the main, so finished and picturesque that it is sure to attract and interest every lover of birds. In the present instance, the only fault we have to find with these biographies is that they are often too brief and general,—in short, that there is too much condensation. Especially is this the case among water-birds, where the account of habits, distribution, etc., is frequently crowded into a few lines. Doubtless this was necessary

to keep the work within its assigned limits, but it is none the less a disappointment.

One of the most valuable features of the book — to the scientific ornithologist, at least — is the bringing together of previous records pertaining to the rarer birds. In almost all cases these have been exhaustively collated, a work chiefly, if not wholly, performed by Mr. Purdie, whose well-known fitness for the task is a practical guaranty of its thorough accomplishment.

The weakest spot in the structure is that of the editor's rulings on questions affecting the comparative abundance and seasonal distribution of the less-known birds. In many — far too many — cases, his conclusions are more or less unwarranted or premature; in not a few, they are positively and demonstrably erroneous. This was to be expected, however, in view of the fact that neither editor nor author is known to have had an extensive experience in New-England fields or woodlands; and, considering such limitations, it is chiefly remarkable that they have done so well.

But, despite its shortcomings, 'New-England bird-life,' as a whole, may be honestly characterized as a work of real merit and unquestioned utility. Its faults are seldom vital, its excellences many and obvious. Although a manual, rather than a comprehensive general treatise, it cannot fail to take a high and permanent place among the literature of North-American ornithology. To the student of New-England birds, it is sure to prove a valuable hand-book, adequate for the determination of most problems which the limited field is likely to furnish. There is still room, of course, for the more extensive structures which some

future builders will doubtless rear on this substantial corner-stone.

Before concluding, we find it necessary to revert to a rather delicate subject, — that of the ostensible authorship of the book. In the preface to part i., the editor touches on this, as follows: —

"Mr. Stearns undertook this work several years ago, at the writer's suggestion, that such a treatise was much to be desired, and could not fail to subserve a useful purpose. Having been diligently revised from time to time, in the light of our steadily increasing knowledge, Mr. Stearns's manuscripts have been submitted to the editor's final corrections. In revising, and to some extent rewriting, them for publication, the editor has been influenced by the author's request that he would alter and amend at his own discretion."

Perhaps we are bound to accept this explanation literally; but the reader familiar with Dr. Coues's characteristic style and methods will find few traces of Mr. Stearns's alleged participation. Clearly the 'revising' was very thoroughly done. We might go even farther, and venture the surmise that Dr. Coues not only edited, but *wrote*, the entire book. But is this a matter with which we have any business to meddle? Probably not so far as Dr. Coues's interests are at stake. If he chooses to do all the work, and take less than half the credit, it is his own affair. Nevertheless, it certainly *is* our right to challenge a reputation unfairly won, and until further proofs are forthcoming we shall refuse to believe that Mr. Stearns's agency in 'New-England bird-life' has been much more than nominal. Perhaps the inside history of the book will never be made public, but intelligent ornithologists are likely to see through a millstone with a hole in the middle.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF SECTION H. — ANTHROPOLOGY.

ADDRESS OF OTIS T. MASON OF WASHINGTON, D.C., VICE-PRESIDENT OF THE SECTION, AUG. 15, 1883.

THE SCOPE AND VALUE OF ANTHROPOLOGICAL STUDIES.

EVERY thing that comes before the human mind has to pass through a process of weighing and measuring, and receives a valuation according to the thinker's standards of merit. In this critical spirit let us pass in review those studies called anthropol-

gical, in order to form some estimate of their value according to the measures commonly applied to various departments of learning.

Anthropology is the application of the instrumentalities and methods of natural history to the inductive study of man. The anthropologist, in this sense, is not a dilettante philosopher, who inquires into old things because they are old, or into curious things while they are curious, omitting all the great movements and needs of society, and overloading the baggage-train of progress with trumpery picked up along the march. The practical spirit of our age demands that we ask what truth, or good, or beauty

comes from such investigations, and how we can make them subservient to human weal.

As to the scope of anthropology, we may be instructed by the work of others. The natural history of any species, say of the domestic horse, includes many inquiries, such as the time and place of its origin; its ancestry; its pristine size, appearance, and mode of living. We should afterwards inquire concerning the archeology or the paleontology of the Equidae, their embryology, anatomy, physiology, diseases, abnormalities, and external characteristics. Mr. Romanes would have a chapter on the intelligence of the animal, as to its nature and amount, supplementing the discussion with notes on the various ways in which the horse manifests its mind, its wills, emotions, and opinions. Horses do not construct elaborate houses like the ants and the beavers; but the members of all species occupy their daily lives in some habitual industries by means of which they wear out the excess of muscle. Sir John Lubbock would lead us farther, and show us that horses go in droves, follow a leader, plan migrations, attacks, and defence, amuse themselves, enjoy one another's company, improve in appearance, intelligence, and usefulness by cultivation, — in a thousand ways show themselves to be social creatures. At last Mr. Mivart would insist that the horse has its habitude (*ἔξῃς*), its manner of action, its economy (oecology), and its members are affected in a characteristic manner by heat, light, moisture, winds, the kind and quality and abundance of food and drink, by beneficial or injurious animal neighbors, and by the vital, procreative, inheritable energy with which they are endowed. These and many other kindred inquiries concerning this homogeneous group would constitute the science of hippology.

The conscientious devotee to this science would frequently ask himself what practical good would result from all this expenditure of time, thought, and resources necessary to collect specimens and facts, and to formulate his science. Could they be employed on some subject more ennobling and profitable to himself, better calculated to inform, enrich, and beatify mankind?

Now, instead of horses, let us substitute the *genus homo*, laying aside all predilections; and, if possible, let us imagine the student of anthropology to belong to quite another genus than the subject of his research. He would have, in the fourteen hundred millions of human beings now living on the earth, and the remains of their congeners slumbering in its bosom, perhaps the best defined group of animals. Calling them a genus or a species, as you like, they are so well hedged off from all other animal groups that not the least embarrassment has ever disturbed the naturalist in distinguishing the anthropos even from the anthropoid. No one was ever puzzled to tell, concerning any living thing, whether or not it was a human being. The earth has never yielded a bone concerning which the practical anatomist stood in doubt whether it had been once part of a human body.

Now, I take it for granted that any inquiry what-

ever which would be useful or entertaining respecting another species would be intensified in importance having man for its object. Indeed, there are few questions which naturalists are wont to propose to their groups which ought not to be carefully considered when we are studying man. Before entering upon the weighing process, therefore, it may make our task more easy if we consider the present scope of anthropology, and briefly pass in review some of the questions which are being propounded by anthropologists every day.

When did man first appear on earth, — at what time and in what geological horizon?

Have all the individuals of our race descended from a common human ancestry? in other words, are we monogenists, or polygenists?

Where was the birthplace of humanity?

What manner of creature was that first man in specific characteristics, in size, aspect, intelligence, and social condition? and how did he get here?

To all such queries, Haeckel aptly gives the name of anthropogeny: therefore, in order to be anthropologists we must be anthropogenists.

Another set of questions relates to that stretch of time which lies between the pristine man, or the pristine condition, and the beginnings of recorded history.

Have we complete, irrefragable evidence that our race has progressed from a brute-like condition, in which it was devoid of all experience and appliances?

What application must we make of Professor Tylor's belief that civilization has progressed upward like a column of vapor, some parts advancing while other parts are being rolled downward, but, on the whole, ascending and expanding?

Granting that there has been improvement, what paths have been pursued?

Speaking of our own peculiar province, what is the real import of such discoveries as those of Dr. Abbott and Professor Whitney in establishing the great antiquity and early rudeness of the American savage?

Who were the builders of the mounds, earthworks, cliff-dwellings, and the stone structures of Middle America?

What were the functions of these various edifices?

What credence is to be given to the early historians of American culture?

Already we have our schools of interpretation, such as the Bancroft school and the Morgan school. Where, among these opposing schemes, does the truth lie?

In the administration of this science, there is occupation for the greatest diversity of talent. The biologists of our time are entering into the minutest inspection of the life-history of each animal form. With enthusiasm the embryologists trace the modifications of structure as they succeed one another in the germ. Before their eyes the very play of creation is dimly shadowed, and organic structure built up. They pass their work on to the anatomists and physiologists. Now, the anthropologist must endeavor to comprehend the whole in its synthesis. As Newton and Laplace grasped the unity and organization of

the stellar world, as Humboldt gazed upon all created things as elements of the universal cosmos, as Darwin first conceived the consanguinity of all living beings and their mutual help or harm, so the anthropologist seeks to unite all that can be known respecting man into a comprehensive science, and to study the innumerable correlations which bind the most incongruous actions and thoughts together in harmony.

May we gain help, in solving questions of human origin, by carefully observing the evolution of the embryo?

Does a knowledge of the life history of the individual furnish a clew to the life history of the species?

What does a comparison of the anatomy of man with that of the quadrumana say respecting the genealogy of the species?

What are the proper methods and instruments of anthropometry, — observing the growth of children, the dimensions, angles, and curves of the cranium, the diversity and size of the brain according to age and sex and race, the weight of the body, the color of the skin, hair, and eyes, the muscular movements, the development of faculties, longevity, fecundity, plasticity under change of environment, and vigor? and what are the legitimate inferences to be drawn from such investigations?

Finally, by what devices can the multitudinous correlations of structure and function in the human body find expression in graphic methods?

Another set of observers must now be brought into this great laboratory. We have to deal with a group of animals in which intelligence has manifested itself to such a degree as to dominate all other functions. Teleological inquiries can be no longer excluded. Hitherto the application of scientific methods to the mind has required that we should be satisfied with sensuous results of thought, and forbidden us to inquire into the nature of the mind itself. Now, we are met at the outset with this puzzling question: Shall consciousness or introspection be admitted as an instrument of observation?

How are we to record its dicta? and how (to borrow a term from the astronomers) shall we eliminate the personal equation?

Or, if we are not in a position to admit introspection among our tools of observation, can we not invent some delicate apparatus by means of which the strength of feeling and the inmost thoughts may be known and measured?

Does the brain generate thought as the liver generates bile?

What can science tell us concerning the existence of a human soul, non-material, and not susceptible of measurement by the standards of well-known forces?

How does it come about that children inherit the traits, tendencies, and faculties of their progenitors?

By what routes does the mind pass on its way from infancy to maturity?

What use should be made of the multitudes of inquiries prosecuted with reference to the minds of animals, in the study of human reason?

The student of anthropology frequently finds himself in sympathy with Wordsworth, singing, —

“Our birth is but a sleep and a forgetting;
The soul that rises with us, our life's star,
Hath had elsewhere its setting,
And cometh from afar.”

If, as Mr. Spencer says, that which we inherit represents the accumulated experiences of a thousand generations, is it also possible to retain the consciousness of those experiences? Will the sensitiveness of consciousness keep pace with the growth of knowledge, and obviate the necessity of laborious records? In which case we should have mental and spiritual atavism explained, and that universal sympathy felt by cultivated people for those standing on the lower steps of civilization.

Now, whatever thoughts any other creature than ourselves may have, and leaving out the possibility of mechanical mind-reading in the future, up to this time the only knowledge men have gained about one another's thoughts has been acquired from expression. The expression of thought is language. Dr. Hoffman finds language in rock paintings and carvings; Col. Mallery, in gestures; Mr. Thomas, in the Maya hieroglyphics; and the glossologists, in human utterance. Happily for us, they are a clever set, and well up in their craft. Let us hear some of the questions they are discussing:—

What are all the devices employed by living creatures to express their thoughts, emotions, and volitions?

Which took precedence in the origin of language, signs, or vocal utterances?

What is the explanation of the origin of language?

What light does language throw upon the origin of species?

Is the evolution of language a safe guide to the knowledge of the unfolding of the human mind?

By what lines have the forms of speech progressed?

How far is similarity of language an evidence of consanguinity among peoples?

Is there a genetic relationship between monosyllabism, polysynthetism, and inflection?

What credit must be given to the ear, and the invention of writing, in the conservation, and lines of progress, of language?

How should languages be classified?

Here we may leave the students of language, and take a new guide. Looking over the earth, we behold men divided into races or consanguineous groups, filled with race prejudices, and restricted by race capabilities.

What are those external and anatomical characteristics which have become transmissible by inheritance? When and how were they fixed? Are we to imagine, with Dr. Kollmann, that certain race forms were fixed far back in the past, just as the chemical elements were made irresolvable by a former state of matter?

Of these heritable marks, which is the best criterion of race, — the skull, the color of the skin, the texture of the hair, language, art, social organization, or mythology? or is it certain fixed correlations of these

and other characteristics? If so, what are the laws of correlation and conservation in the races? Should the same set of structures be depended on in each race? How many races of men are there? and are these species, or varieties?

In what manner should the question of race enter into the administration of politics, economy, education, and colonization?

It is impossible to say when this subject of race first became attractive to human minds. In the oldest histories and on very ancient monuments, are to be seen attempts to classify the families of mankind. In all the encyclopaedias, under the word 'ethnology' will be found the schemes of modern writers. But, since the commencement of our century, the subject has been taken out of the hands of individuals, and has engrossed the attention of societies. Manuals of instruction have guided the voyager and the traveller in recording the characteristics of races. In Stanford's Compendiums, based on von Hellwald, Mr. A. H. Keane has commenced a codification and synonymy of all the tribes of men. This he proposes to follow up with a biographical dictionary of tribes. The Bureau of ethnology has collated the names, priscan homes, migrations, and bibliography of all the North-American Indian tribes. So that we are in a fair way to know something about the races of men, by proceeding from particulars to a general view.

Passing from man to his works, we are face to face with aesthetic and practical art as a unique study. All art relates to human desires for food, clothing, shelter, for activity in peace and war, for beauty, for social and spiritual happiness. Mr. Tylor has taught us to look upon art products as species that have had an evolution, a life history; and this was very much the plan of Gustav Klemm. This sort of study has captivated many anthropologists, and they are asking such questions as these:—

Admitting that the arts have been progressive, what have been the lines of their elaboration?

May we, by a process of elimination, trace backward the life history of each art, as a patent attorney or a chancery lawyer?

At what degree of workmanship may we be sure that flakes of flint, gashed bones, and wrought wood, give evidence of human handicraft?

When does similarity of art-forms indicate social or commercial contact? when, consanguinity? and when, merely the same gradus of culture?

Is degenerate art a facsimile of early, progressive art?

Is it allowable to fill up the gaps in the arts of any tribe by seemingly intermediate forms from other tribes?

Whence is the sense of beauty?

The answers which we unconsciously give to these queries are the major premises of our arguments respecting the history of civilization.

By marriage in some of its forms, human beings are united into consanguineous groups, whose other needs demand and produce other bonds of union, and widen the separation from other groups. With reference to each set of duties in the tribe, unwritten or written

codes embody a system of ethics, regulating conduct in every particular. Farther on in their history, groups have relations of war and peace, and the absorption of homogeneous and heterogeneous peoples into a defined area gives rise to nationalities.

Were men ever herded together in promiscuity?

What were the earliest forms of social life?

What were the most primitive forms of marriage in groups?

Have all the tribes of men passed through the same systems of consanguinity and affinity?

Can the highest systems of altruistic ethics be explained by natural processes?

What are the most beneficial relations of labor to natural resources? and how have the present relations been brought about?

What is the history of the control of the body politic over the individual, and of the jurisdiction of corporations? and to what extent may individual freedom be controlled without discouraging private ambition?

What has been the life history of communism, crime, fashion, and politics?

Is it possible to regard and define facts in sociology by the terms of physical science?

Again, these human beings spend a great portion of their time acting and speaking as if other eyes and ears than those of mortals were cognizant of them. In the darkest nights, at the rising sun, throughout the day, at certain seasons of the year, this unseen world is involved. In groves, in caverns, in estufas, or in costly temples, it is all the same: praises, petitions, and offerings confront the inscrutable power that can work men weal or woe.

How did man come to believe in the animation of things, fetiches, the wanderings of ghost-souls, spirits benevolent and malignant, the gods of classic mythology, and the Great Father of all?

What are the first conceptions of children respecting such things? and will these guide us aright to the childhood of faith?

Has the history of mythology run parallel with the history of material and intellectual progress?

How may we divest ourselves of the personal equation, and learn the true psychology of savage worship?

Is Dr. Brinton right in applying the rules of interpretation adopted for Aryan mythology to American Indian myths, and in assuming that their crude stories are disguised dedications of the phenomena and powers of nature?

Finally, as men wander about the earth, and certain families are to be found chiefly in certain localities, so is it with races. Longevity, fecundity, and vigor are influenced by such causes as height above the sea-level, purity of the atmosphere, amount and distribution of heat, moisture, winds, fertility of the soil, and proximities, whether they be vegetal, animal, or human, whether they be beneficial or injurious.

By what subtle chemistries of the things around us, by what exposures in this terrestrial camera, come to pass the various hues of the skin and hair and eyes, the long skull and the short skull, the long face

and the broad face, and the fixed compounds called natural characteristics?

By what processes of selection and adaptation has this cosmopolitan species come to occupy the whole earth, its genial climes, its frozen areas, and its fever-cursed tropics?

Is it possible to control these phenomena, or to adjust the human machine so as to anticipate and assist nature, to expedite natural selection and the survival of the fittest? or even to subdue nature, and decide for her what shall be the fittest to survive?

From this hasty survey of the scope of anthropology, we return to inquire what benefit the world derives from the cultivation of this science.

I answer, firstly, that every study is improved by study. All things become clearer to him who steadily fixes his gaze upon them. The sciences all began with vain speculations, — astronomy with astrology, chemistry with alchemy, geology with cosmogonies, biology with nature-worship, and theology with mythology. Long before the word 'anthropology' was employed in its present acceptation, Alexander Pope wrote, "The proper study of mankind is man." But, millenniums before his day, mankind studied mankind by the light of their time. The study of man is no new thing, therefore. Now, since human thought has run, and will continue to run, in that direction, it becomes our privilege to rejoice that the stream has in these last days run wider and deeper and clearer. The proper study of mankind is the scientific study of man, the multiplication of rigorously exact observations, the collection of thousands of well-authenticated specimens, the classification of both observations and specimens on rational bases, and the limitation of our conclusions to the extension of our premises. Some of my hearers have worked systematically and patiently for years at American archeology, or the anthropology of the modern Indians; and you rejoice with me to-day that our science has at last attained dignity and respect. With profound veneration I mention the names of Hildreth, Atwater, Stephens, Gibbs, Schoolcraft, Morton, Gallatin, Wyman, Squier, and Davis: with what buoyant hope they looked forward to this day, and with what exquisite pleasure must such living witnesses of the beginning as Horatio Hale, Col. Whittlesey, Dr. Jones, and Mr. Hempstead now contemplate the progress of solid work! The Smithsonian institution will have to republish Squier and Davis, with many additions and corrections by Dr. Rau; the Bureau of ethnology will antique Schoolcraft and Gallatin and Gibbs; Morton's and Wyman's work will be entirely superseded by that of the Peabody museum and the Army medical museum. The Archaeological institute of America will throw new light upon the researches of Stephens; and Mr. H. H. Bancroft will make it entirely unnecessary to wade through thousands of pages of ancient Spanish literature. Therefore the first and most beneficial result of modern anthropology has been the direction of an immense amount of rambling and disorganized labor into systematic and rational employment. This clearing of rubbish, correction of misconcep-

tions, cultivation of a modest spirit, willingness to abide the result, multiplication of materials, refinement of instruments, improvement of processes, in a study which thousands are determined to pursue, must strike every thinking person as a wonderful reformation.

Secondly, the value of a study must be estimated by its effects upon human weal. Farmers, miners, fishermen, lumbermen, mechanics, are slow to recognize their debts to the man of science. But who can estimate the millions of dollars saved by such studies as those of Packard, Riley, and Thomas, on the grasshopper, potato-beetle, and army and cotton worms, and the confidence engendered by the belief that a knowledge of the habits of these animals would lead to their conquest? It would take but a few moments to show that this argument applies with manifold force to the study of man himself.

It is not enough for the good physician to know the nature of remedies, or the use of knives and diagnostic apparatus. Sad will be his use of these if he has not familiarized himself with the structure of the human body in health and in disease, and, above all, if he has not made a correct diagnosis of his patient's case. Are not all the questions asked in the first part of this discourse, and many others agitated by anthropologists, connected with human welfare? Do they not relate to the body, mind, and speech of man, to the races of mankind, their arts, amusements, social needs, political organizations, religion, and dispersion over the earth? For instance, the French in Africa, the British in India, and our own citizens in malarious and fever-laden regions, — have they not learned from loss of treasure, ruined health, and the shadow of death, that there is a law of nature which cannot be transgressed with impunity?

It is the same with sociology and religion. The pages of history glow with the narratives of crusades against alleged wrongs, which were in reality campaigns against the sacred laws of nature. Social systems, which had required centuries to crystallize, have been shattered in the effort to bend them to some new order of things. Arts and industries planted in uncongenial soil, at great expense, have brought ruin upon their patrons, who had not studied the intricate laws of environment.

What a modification of temper, for instance, has been wrought among Indo-Germanic peoples by those studies in comparative philology which have led them by the hand back to their priscan home, and demonstrated, that though they may have aggregated into antagonistic nationalities, and fostered inimical industries, the same blood courses through their veins!

The better knowledge of race and race peculiarities has revolutionized and humanized the theories of aborigines. The doctrine of extermination, formerly thought to be the only legitimate result of colonization, has become as odious as it is illogical.

The inductive study of mind has hardly begun; but how much more successfully and rapidly will education and the development of the species progress when the teacher and the legislator can proceed at

once from diagnosis to safe prescription, when natural selection and human legislation shall co-operate in the more speedy survival of the fittest! The time seems to me to have arrived when our great anthropological societies and institutions should institute a systematic, co-operative study of psychology.

In a land where the archeologist may tally off most of his finds by savage implements in use at his very door, it seems like presumption to speak to you of the advantages of the most careful archeological methods. But there is a difference between the old and the new archeology. There are times in the settlement of a new country, when every man is his own carpenter, smith, and physician. But how soon your energies have worked out of that! Now I speak only of professional archeology and its advantages. How many mistakes of his predecessors has Mr. Putnam alone corrected? We have all read with pleasure his recent correction of Dr. Hildreth's mistakes about iron in the mounds. It is so with your archeological collections: only those gathered in a scientific spirit will have any lasting value. But in the accumulation and preservation of such, you are the storers of force of the greatest value. You are recovering the scattered fragments of an ancient mosaic which will one day be reset, and its legend will be the lost history of prehistoric man.

The third benefit to which I will call your attention is the opportunity which the science affords for the exercise of every talent, even the highest. The difficulty of any problem depends upon the number or the degree of its unknown quantities. When facts were few, and the data of the science were beclouded with many sources of error, no wonder that men of logical minds left these investigations to those of a more imaginative disposition. Their crude, preliminary efforts have given place to organized work, directed by men of the greatest executive ability, assisted by skilful specialists, and endowed both by private munificence and by public appropriation. Not to go beyond the limits of our own country, we all point with pride to the Peabody museum, the Archaeological institute of America, the American antiquarian society, the museums of New York city and of Philadelphia, the Smithsonian institution, National museum, Bureau of ethnology, Army medical museum, and the Anthropological society at Washington, the academies of Cincinnati, St. Louis, and Davenport, and the historical societies of many of our states, including the Minnesota collections.

Now, the special merit of such great centralization of resources is that everybody can study something. It is possible for every craft and profession thus to prosecute its researches and to make its contributions. During the past winter, papers were read before the Anthropological society at Washington by comparative anatomists, biologists, archeologists, geologists, physicians, paleographers, sign-linguists, philologists, patent-examiners, artists, statisticians, sociologists, clergymen, metaphysicians, and ethnographers. And this does not exhaust the scheme. Mothers, school-teachers, those in charge of the insane, the criminal, and the defective classes, law-

yers, mechanics, musicians, philanthropists, legislators, may all contribute to this science some handiwork which will help to make the pile complete. To be still more personal, permit me to say to each one before me, that there is anthropological work which your peculiar occupation fits you to do better than any one else on earth. For example, a distinguished ornithologist, Mr. Henshaw, has recently identified all the birds in the well-known mound-pipes. An artist, Mr. Holmes, has succeeded in bringing order out of confusion in the shell ornaments of the mounds. A patent-examiner, Mr. Seely, traces backward aboriginal art. A general in the British army, Pitt-Rivers, worked out the history of the elaboration of the implements of war. An educator, Mr. Peckham, has recently given us the result of a laborious investigation on the growth of children. The geologists must interpret for us the significance of our discoveries in the drift. Where can I stop? I will boldly avow that the day of tyros is gone. There is a great multitude of collectors throughout our states who will have to go to school to Professor Putnam, or Dr. Rau, or Dr. Thomas, before they will have the faintest conception of the significance of their treasures.

The inevitable result of special research is generalization. Kepler, Newton, Count Rumford, Kirchhoff, Bunsen, and Darwin, are names that stand for these processes in material science. To Herbert Spencer we are indebted for the first effort in this direction respecting human phenomena, and his work will be revised and corrected by those who will approach the task with better instruments and more reliable material.

In this heaving mass of humanity, returning into itself ever with vast gulf-streams and eddies, each actuated by its special forces, there is, after all, orderly motion. We discover that our little circle is part of a greater circle, and for a moment the mind is satisfied in the contemplation of this wider truth. Recovering, and renewing our investigation, the fact is reached, that this and its congeneric circles are part of a greater movement more complicated and perplexing. By the pursuit of this wider knowledge the intellect is strengthened, and thereby is brought about the natural selection of the mind. While many tire, or are unable to comprehend the situation, others press on, and grow strong by the effort.

The last advantage of which my time will allow me to speak is the assistance which such studies render to philanthropy and legislation.

Standing on the deck of a steamer, and looking at the land left behind, we seem to be but a mile or two away. We are surprised with the information, that what seems so near is many miles distant. It is so with human history. In our childhood we believed that the first man walked the earth only a few centuries ago. All the events known to us then could easily have occurred in that brief period. The increase of knowledge expands the boundaries of time, and the origin of man is now lost in the mists of the past. Could any thing fill our minds with greater love for our race than the magnificent struggle they

have made in these millenniums? At the other end of the journey we were no better than brutes, and now we look out upon the cosmos as something reasonably comprehended.

If 'pity for a horse o'er-driven' fills the heart of the poet, with what tenderness should we look upon the savage races, and remember that the whole family of man has stopped, some time or other, at that wayside inn! Each aberrant form, abnormality, criminal, dwarf, and giant shows the by-paths of human growth into which our life-stuff may have wandered. The arrow is the parent of the cannon-ball; the stone or bone spear-point, of the bayonet; the flint chip, of all edged tools; the cave-man, of the French *savant*; the hut, of the palace; the tattoo, of regalia; the gorget, of the crown jewels; the quipo and pictograph, of the printed book; promiscuous concubinage, of holy wedlock; the hunting-party, of society; the clan, of the state; the fetich, of the pantheon; and universal animism, of universal causation. Instead of our ancestral belief in a tree with roots in the earth and branches in heaven, our tree has its roots in the past, and is ever putting forth leaves and flowers in a brighter present.

All sciences are retrospective. The astronomer, the physicist, the biologist, find the bases of their prophecies in the past history of the universe. The statesman, if he be wise, will imitate their example, and feel secure of his legislation for the future only so far as it is founded upon an intimate knowledge of the past.

The value of this study to philanthropy is easily shown. With what admiration do we read of the devotion of those missionaries who have suffered the loss of all things in their propagandist zeal! Science has her missionaries as well as religion, and the scientific study of peoples has notably modified the methods of the Christian missionary. The conviction that savage races are in possession of our family records, that they are our elder kindred, wrinkled and weather-beaten mayhap, but yet worthy of our highest respect, has revolutionized men's thoughts and feelings respecting them. The Bureau of ethnology has its missionaries among many of the tribes in our domain, no longer bent on their destruction, but treating them with the greatest consideration, in order to win their confidence, to get down to their level, to think their thoughts, to charm from them the sibylline secrets. It sounds something like the old Jesuit relations, to hear of Mr. Cushing at Zuñi, eating vile food, wearing savage costume, worshipping nature-gods, subjecting himself to long fastings and vigils, committing to memory dreary rituals, standing between disarmed Indians and their white enemies on every hand, in order to save their contributions to the early history of mankind. You will recall the fact, that an honorable senator more than a year ago offered, as an argument against sudden disruption of tribal affinities, an elaborate scheme of the Wyandotte confederacy. Max Müller says, "He who knows little of those who preceded him is likely to care little for those that come after. Life would be to him a chain of sand, while it ought to be a kind of electric chain that

makes our hearts vibrate with the most ancient thoughts of the past as well as the most distant hope of the future."

In the study of this anthropo-cosmos, as in other studies, we are brought face to face with the inscrutable. In these voyages of discovery we have no right to expect that we shall ever find a passage to the ultimate truth. As with the child, so with the man; as with the individual, so with the race; as in the past, so in the present and the future, — the solution of one problem only prepares the way for many far more complicated. With all our sciences comes the consciousness of new ignorances. There is more known to be unknown now than when wise men knew that they did not understand many things well known to us. So will it ever be. Just about one hundred years ago, Peter Camper's measurements of the facial angle, with a few observations on height and weight, were thought to be all that anthropometry could furnish to the natural history of man. In 1881 Paul Broca laid down for the skull and the encephalon more than one hundred and fifty measurements; and the Germans go beyond that. Think you, the weighing and measuring will stop at these? We are just on the threshold of applying experienced training and instruments of precision to the study of man. Examine, if you please, the circulars for information issued by the old Paris ethnological society, Albert Gallatin, Lepsius, Max Müller, and the Smithsonian institution, with those published for the Novara expedition, by the British association, Kaltbrunner, Roberts, the new Paris society, or Major Powell, and you will have ocular evidence of the advance of anthropology.

But there is no Ultima Thule in science. No question propounded to nature will ever be answered. I can imagine the night of despair that would settle around any one of my hearers when he had reached the consciousness of having gathered the whole harvest of truth. On the other hand, I am sorry to hear any of our great thinkers uttering the words *ignoramus et ignorabimus* as a wail of despair. They should be to all the sweet voice of hope. They do not mean that we know nothing, or that we shall ever remain totally ignorant. Fresh, vigorous, buoyant, science feels itself to be on a pleasant journey, whose destination may remain unknown, but every mile of whose progress unfolds new vistas of beauty and variety in nature, each transcending the other.

I congratulate you, dear friends, that the American association has delegated to you such an important trust. The illustrious names to be found among our members and fellows are a sufficient guaranty that you have lighted your torches, and that our science will not be a laggard in this grand march. Professor Henry said, in 1859, "The statement cannot be too often repeated, that each branch of knowledge is connected with every other, and that no light can be gained in regard to one which is not reflected upon all" (Smith. rep., 1859, p. 15). We may go farther, and say, that, whenever any marked generalization is made in any science, all other sciences proceed at once to put themselves in line with the new order. It is the duty of the anthropologists, therefore, not

only to rejoice in the growing light of chemistry and biology, but, quickened by their warmth, to put forth new life and vigor, and to apply to their investigations the most refined instrumentalities and the most subtle thought; believing with Lord Lytton that man is a subject of far nobler contemplation, of far more glowing hope, of a far purer and loftier vein of sentiment, than all the 'floods and fells' in the universe.

PAPERS READ BEFORE SECTION H.

(MOUNDS AND MOUND-BUILDERS.)

The great mounds of Cahokia.

BY WILLIAM McADAMS OF ALTON, ILL.

THE mounds referred to are in the locality known as the 'American bottom.' The region so called is a strip of alluvial land in the state of Illinois, lying between the bluff and the Mississippi river, and extending from the city of Alton to a point below the city of East St. Louis. A map of the locality, showing the places and dimensions of the mounds, was exhibited before the section. The mounds are over two hundred in number, and are the largest in the United States. A group of seventy-two mounds on the Cahokia creek was specially considered. The central mound of the group is the largest: it is a hundred feet high, and covers fourteen acres of ground. It is a truncated pyramid with two terraces: its flat top has an area of one and a half acres. The surrounding mounds are thirty to forty feet high: they are square, in this respect differing from the conical mounds of Ohio. The mounds on the bluff seem to be of a different order, being only four or five feet high, and round or oval. Unquestionably the mounds of the Cahokia valley are artificial, being made of black alluvial earth, entirely different from the ground on which they rest.

The author accounted for the fact that there were few mounds on the banks of the Mississippi river, by supposing that the mound-builders were afraid of their enemies beyond the stream.

Numbers of relics have been found in the Cahokia mounds, mostly of flint, some of them eighteen inches long. The finest is a white flint axe, which is of a smoothness and polish like ivory. In reply to an inquiry, the author stated that there had been considerable alluvial deposit formed since the mounds were built. The subsoil is a yellow clay loam: under the mounds is a floor of white sand.

In discussing the paper, Gov. Bross stated that he had discovered, on the top of the only round mound of the group, a large flat stone, which he thought might have been used for sacrificial purposes. A skeleton had been found, of a man more than six feet high: the whole series of mounds gave evidence of the energy and industry the men of that time had possessed. Dr. Hoy said that there was in Africa a mere bird that threw up a mound fifteen feet high, so that these men might not have been even large. Mr. Putnam expressed the opinion that the mounds

were simply a site for a town, and not a worshipping-place. Mr. McAdams said he had been led to believe they were places of worship, by the use of just such mounds for places of worship in Mexico, their sun-worship being their government. There are few, if any, evidences of habitation.

Metrical standard of the mound-builders, by the method of even divisors.

BY CHARLES WHITTLESEY OF CLEVELAND, O.

IN the absence of the author, an abstract of the paper was read by the secretary of the section. An endeavor was made, by the method named, to ascertain the standard of linear measurement which was used by the mound-builders. It is supposed that they, in common with other early races, used the length of some part of the human body as a linear unit. Several theories of the kind were tested mathematically, but, thus far, with only negative results.

The mound-builders identified.

BY JOHN CAMPBELL OF MONTREAL, CAN.

THIS paper was read by the secretary of the section, in the absence of the author.

It was a pains-taking attempt to trace the origin of the mound-builders in the eastern hemisphere, chiefly by means of a comparison of ancient languages along the line of a supposed route. The line of similarity was believed to indicate that the original people were Khitan or Khitos, Kathaei, Katei, Khilon, or Citem; and that they had made their way across Europe and northern Asia to Alaska, and thence to the United States, down the Mississippi valley, to Mexico.

Professor Mason, the president of the section, expressed the opinion that Professor Campbell was on the wrong track, while complimenting him upon his exceeding zeal and patience in his research. Professor Mason consoled himself, however, with the thought that the author had so thoroughly exhausted the subject that no one would ever attempt a similar experiment. Mr. D. A. Robertson of St. Paul differed from the president, and expressed the opinion that Professor Campbell was on the right track, and that the migration of the mound-builders would be traced from Siberia, or by the European isles, and, if not in one migration, in several.

Typical shapes among the emblematic mounds.

BY S. D. PEET OF CLINTON, WIS.

By means of diagrams, the author exhibited the ground-outlines of different mounds which he had surveyed in Wisconsin, which showed that they had been made in the form of animals, in different postures. There were flying geese, eagles, jack-rabbits, panthers in the act of jumping upon their prey. Many of the supposed effigies were of great size, the tail of one squirrel having a length of three hundred feet. One of the mounds was in the shape of an elephant, with a very pronounced trunk. This mound, however, is now destroyed; and the

only authority for its existence is that of a man now dead. There were mounds, also, in the shape of water-animals, such as turtles, crawfish, etc. His theory of these mounds was, that the animals were supposed to be scattered about to guard the central sacrifice or altar mound. He was led to this belief by observing that the altar mounds are nearly always situated on high ground, overlooking a river, while the emblematic mounds are so disposed around the altar mounds, as to suggest the notion of guarding the latter.

Personal observations of the Missouri mounds from Omaha to St. Louis.

BY E. P. WEST.

IN the absence of the author, the paper was read by Dr. Case of Kansas City.

Observations were given with some detail, by which it appears that the Missouri mounds are built on the lower bluffs or terraces. The author shows also that these mounds must have been coeval with the loess deposits. He says we have reason to believe that the occupancy of the mound-builders was prior to the subsidence of the Missouri river and Kansas lakes, and that it was not continued long thereafter. It must have begun previous to the subsidence, since the remains and implements of this people are found in the undisturbed primitive deposits. Their ingress was probably from the south, and extended northward after the close of the glacial period. Turning northward after the close of the ice reign, they found the warm waters of the Champlain lakes filled with fish, inviting an occupancy along their hospitable shores. Here they erected their abodes, and drew their principal food-supply from the lakes. In time, owing to geological changes, the lakes were drained. The conditions for existence being altered, the lake-dwellers either suffered extinction, or were forced to change their mode of life. Their distinctive characteristics, at any rate, ceased long before the European touched foot on this continent. We have no means of knowing whether they were exterminated by neighboring nomadic tribes, or became themselves nomadic in their habits.

Game-drives among the emblematic mounds.

BY S. D. PEET OF CLINTON, WIS.

INDIAN mounds are divided by the author into five classes, as follows: 1. Emblematic, and built by hunters who worshipped animals. 2. Burial-mounds: this class mostly prevails in Michigan, Illinois, and Minnesota. 3. Mounds which are probably the remains of the stockades of an agricultural people. 4. Village mounds,—the remains of villages, and their high places for worship. 5. The peculiar mounds of the Pueblos and Aztecs.

The first of these classes was the special subject of the paper. The author's theory is, that the emblematic mounds, having the form of the animals hunted, served a useful, as well as a religious, purpose. He regards them as having been employed by the hunters as screens from behind which to shoot the ani-

mals which would pass along the game-drives between the mounds. Diagrams and charts were used to illustrate the theory.

(OTHER ANTHROPOLOGICAL PAPERS.)

In-door games of the Japanese.

BY E. S. MORSE OF SALEM, MASS.

IN introducing this subject, Mr. Morse said that there are curious affiliations between the Japanese and the American Indians, which may some time show a connection by family ties. Among the simple in-door games of the Japanese are some that are played with balls, jackstones, and cat's-cradle; but all these are more elaborate than with us, and the cat's-cradle goes through a far greater variety of changes. The author believes that the greater intricacy of Japanese simple games is due to the fact that older people take more interest in them. Among these games, there is one similar to 'Simon says thumbs up;' there are tricks with the hands, much like our own; and there are numerous games of striking hands, which appear easy, but require much practice to acquire adroitness. There are many games that test strength or endurance; among them are some in which ears and noses are pulled, and others where the competitors each hop on one foot, and try to push their rivals over.

They have a more elaborate game of checkers than ours. The pieces are placed on intersections instead of on squares. It frequently takes a month to play one game, and the players often deliberate over a move for an hour or two. Experts in the game acquire a wide reputation. Japanese chess is probably the most intricate game in the world. The board has 81 squares, and 20 pieces are used, which have moves somewhat like our own, though none are exactly similar. The pieces change in grade when they arrive at a certain position on the board. The strangest feature of the game is, that either player can take any piece which has been captured from him, replace it on the board, and use it against his adversary. This makes the game utterly bewildering to a foreigner.

The Japanese have no games with spotted and court cards like ours; but they have a card game of 'authors,' which compels players to cap verses of classic poetry. Mr. Morse was delighted to find this intellectual amusement a favorite with the Japanese; and he hopes they will never substitute for it our inferior struggles in seven-up, whist, and euchre.

Life among the Mohawks in the Catholic missions of Quebec province.

BY ERMINNIE A. SMITH OF JERSEY CITY, N.J.

THE paper was an interesting account of the Indians brought under Roman-Catholic influence by missionary labors continued through many generations. These Indians regard their priests as temporal directors as well as spiritual fathers. The manners and customs of the Indians were described, and some account was given of the studies of the author in the

Indian dialects of the province; noting, especially, the more curious peculiarities of the language, the dialectic differences of the tribes, and the modes in which such changes have been effected.

The principal occupation of the men is that of boatmen on the St. Lawrence, though the bead-work goods of the tribe are sold everywhere. The speaker detailed her exciting experience in shooting the rapids of the St. Lawrence, on a raft, under the skilful charge of these Indian boatmen. Many of the laws of the old aboriginal Mohawks are forgotten by the tribe described. The significance of some of the wampum-belts was outlined; and the speaker recited the legend of the old bell in the chapel, closing with a tribute to the zeal and the results of the labors of the old Catholic priests who have worked so long among these Indians.

An exhibition was made, in connection with the reading of the paper, of wampum-belts, drawings of ornaments, and the work of the earlier priests, including some literature.

Observations on the laws and privileges of the gens in Indian society.

BY ALICE C. FLETCHER OF NEW YORK.

THIS paper was read by the secretary of the section, in the absence of the author.

An elucidation of the customs and circumstances under which the gens system in Indian tribes supersedes parental ties, was the chief feature of this paper. The author had an excellent opportunity for observations of this character, during the work of placing the Omaha tribe of Indians upon their lands in severalty, and while adjusting the line of descent and inheritance according to our laws.

"A child who has lost its father or mother is considered an orphan. Its particular place is gone, and it passes into the gens." Beyond the foregoing statement, the paper does not make it quite clear, whether, in case of the death of the mother only, the child remains somewhat under direction of the father, or is wholly assigned to a family of the father's relatives.

But as to the results when the father dies, leaving offspring, the paper is quite explicit. In that case, the mother loses all maternal rights. Each child, unless of very tender age, will be separated from the mother, and will go into the family of some one of the father's relatives. It may thereafter be claimed as his own child by the male head of the family to which it has been allotted. This separation of her children from a widow is permanent. She usually marries again, and in that event is not burdened with her offspring by previous husband or husbands; but if she should remain unmarried, she would be expected to work for the family that has adopted her children, rather than for the children themselves. If she dies when her children are young, it is probable, that, at maturity, they will have forgotten even her name.

The women are not wanting in affection for the children of whom they are bereft; but the separation is looked upon as a matter of course, none of the

interested parties regarding it as a grievance, or even a hardship. It surprises an Indian to have the propriety of this arrangement questioned. No point of our law of inheritance is so difficult for him to understand, as that which binds together the child and the surviving parent.

Young men whose mothers are of the same gens are accounted brothers to each other, and the brothers of the mothers are uncles. Between these uncles and the nephews and neices, there is an easy familiarity, not unlike that of parents and children.

The author has observed a decided lack of family likeness among Indians. This observation applies, however, to entire families, which include cousins, aunts, and uncles; a striking resemblance between parents and children being not unusual.

The Indian may be 'the stoic of the woods;' but he is neither averse to pleasantries, nor deficient in sensitiveness of a certain kind. He delights in chaffing his fellow Indian; and dreads, more than aught else, being made a laughing-stock.

Symbolic earth formations.

BY ALICE C. FLETCHER OF NEW YORK.

THIS paper was read by the secretary of the section, in the absence of the author.

By the foregoing title, the author refers to certain heaps of earth which are piled up with care and formality during religious ceremonies of Indian tribes. Miss Fletcher has in previous papers described the preparation of these little mounds among the Sioux, where it formed part of every religious ceremony she witnessed. The present paper described this practice among the Winnebagoes in the 'buffalo-dance,' which is given by them four times in May and early June. The Winnebagoes, the author says, are admitted to be one of the older branches of the great family to which their tribe belongs. Their antiquity is shown by the construction of their language, by finding many religious ceremonies of different tribes referred to the Winnebagoes, and by Winnebago words used by other tribes in connection with religious ritual.

The buffalo-dance was described in detail. As the dancers enter, each woman brings in a handful of fine earth, and deposits it, so that two small mounds are raised midway between the eastern entrance and a fire which is about fifteen feet from the entrance. The mounds thus formed are truncated cones; and an old Indian said to Miss Fletcher, "That is the way all mounds were built: that is why we build so for the buffalo." The mounds were about four inches high, and not far from eighteen inches in diameter. When the mounds were completed, the head-gear of the four male dancers was placed upon them, consisting of claws, tails, and other trophies of the chase. The men imitate the buffalo in his wild tramping and roaring. The women follow in single file, each with her feet nearly straight and her heels together, propelling herself by a jerk of the body, or a kind of hop. The appearance of the entire line of female dancers is suggestive of the undulating movement of

a herd of buffaloes. The track left by the women's feet is a regular pattern like a close-leaved vine, each woman hopping exactly into her predecessor's footsteps.

The fire before referred to is built east of the centre of the tent, and contains four logs placed with their inner ends joining, and their outer ends toward the points of the compass. During the initiation of a candidate, at a certain point in the ceremony when he has fallen dead to the old life, and is raised to the new, the four logs are taken away, and the ashes are heaped in a sharply conical mound.

The essayist also described one of the sacred resting-places for spirits on the bluffs of the Missouri river. Such places are at intervals about fifty miles apart. They are cleared and cleaned by sacred hands every year. The place contained a depression in the ground, of circular form except as to an extension of the outline in an elongation or entrance exactly pointing to the east. The depression is just one foot in circumference, and about six inches deep. An adjoining tree, now partly blown down, has the reputation among Indians of being haunted by spirits. The author hoped that other observers would be able to trace the probable connection between these observances and the building of the larger mounds.

Osage war customs.

BY J. O. DORSEY OF WASHINGTON, D.C.

THE paper was read by the president of the section, in the absence of the author.

By means of an illustration the preparations were shown which the tribe makes for a war-march, the order followed being that of rank in the tribe. The paper described the tactics by which the Osages camp in a circle, the war-men on one side, and the non-combatants on the other. The road travelled by the Indians forms the line down through the centre of the camp, and the division-line. The great war-tent is placed with the rear to the west, the place of honor being at the east. The author detailed at considerable length, with the aid of illustrated charts, the method of selecting the forces, and the ceremonies preparatory to war, the decoration of the Kean Woctake, or Cheezhoe peacemaker, the form of the dance around the village, the nature of the moving dance, the order of march from home by twos four abreast. Marriage ceremonies and funeral rites were also described and explained in detail. A marked feature of this paper was its use of drawings illustrating the grouping of participants in ceremonies.

The Charnay collection at Washington.

BY O. T. MASON OF WASHINGTON, D.C.

THE collection referred to contains the material obtained by the Charnay expedition to Mexico and Central America. The expenses of the expedition were defrayed by Mr. Pierre Lorillard. The author of the paper called attention to the fact that Mr. Lorillard was not himself proficient in any branch of

science. The success of the expedition showed how a gentleman of fortune might render valuable service to the cause of science, although not specially conversant with scientific lore.

In this expedition, a point was made by obtaining, as far as possible, casts (in plaster strengthened with tow) of the objects of antiquity. By means of these casts, the drawings of this and other exploring expeditions can be verified and corrected. Great success was attained, as to casts from little-known and almost inaccessible ruins; and many new objects of beauty and curiosity were brought to light, among them a large number of interesting reliefs and statues. The casts will be preserved in the museum at Washington, and in duplicate at the Trocadéro museum in Paris. Numerous photographs and drawings were obtained; and measures have been taken, under the auspices of the Smithsonian institution, to reproduce several of the more important ruins by correctly arranging the casts in position with suitable accessories. Good success has already been attained, both in making restorations of ancient temples and other ruins, and in correcting recorded measurements and drawings.

The correspondence between the prehistoric map of North America and the system of social development.

BY S. D. PEET OF CLINTON, WIS.

IN introductory remarks, the author claimed that the American continent was peculiarly favorable for the study of primitive life. The isolation of the continent, and the freedom from historical impressions, had contributed to a unique development. There is no trace of a Homeric age. The symbolism and mythology are homogeneous. In the eastern hemisphere, we have mountain ranges running east and west, which divided races: here we find little trace of such divisions, and the people were to be regarded as a unit.

The theory of the author was, that the development of the North-American aborigines depended upon their surroundings. Dividing the development into three successive grades of savagery, barbarism, and civilization, he found these in successive parallels from colder to warmer climates. The isothermal lines of this continent do not follow parallels of latitude; and due allowance must be made for their deflections to the north and south, in considering the effect of climate upon development. The author differed from Mr. Morgan on certain points. The production of pottery is not so certain an evidence of emergence from barbarism as is the pursuit of agriculture. While Mr. Morgan regarded the development of village-life as a distinguishing feature, Dr. Peet had found traces of village-life everywhere among the aborigines.

In respect to the origin of the American races, the author believed that some aboriginal tribes came from the east, and others from the west. It is possible that this diversity of descent can be detected by careful observation of the tribes on the Pacific coast.

The kitchens of the east.

BY E. S. MORSE OF SALEM, MASS.

THE author, during his travels in eastern Asia, had made some observations on the cooking-apparatus there in common use. The Japanese largely employ a mere fireplace, over which the vessels containing food are suspended by hooks: they have, however, two or three kinds of regular stoves of different designs. In China, stoves of a definite character are in use: one was found in Canton which was very elaborate; it was long, and had numerous openings. In Singapore, there appears to be only one kind of stove; and it is of decidedly primitive construction. In fact, it is little more than a rough trough filled with earth and sand, on which are laid rough stones selected with reference to pots of various sizes; and the fire is built among the stones. The kitchens in which these constructions are found are invariably very dark and dirty. In northern Java the author found a stove made of arched clay, as half an earthen pipe would be if cut through the axis of the cylinder. This half-cylinder is set with the open part down, and fire is built under its arch. Holes are cut through the crown of the arch, to hold some of the pots, while others are merely set upon the surface.

Methods of arrow release.

BY E. S. MORSE OF SALEM, MASS.

THE author recited the rules at present applied in the American system of archery; the bow being drawn with the right arm, the arrow being placed on the left side of the bow, and three fingers being used to hold the arrow. Among the Japanese, a different system prevails: the arrow is placed on the right side of the bow as it is held perpendicularly, and the drawing of the bow is performed with only the thumb and one finger on the shaft. China, Japan, and the Corea are alike in this manner of drawing the bow. Among Indian tribes, the methods of arrow-release differ very widely. In general it may be stated that our system of arrow-release (which the author designated as the Saxon method) is substantially the same as that of the majority of European races, the modifications of the system among them not being important.

The Japanese use a glove with a heavy thumb, and sometimes a heavy ring on the thumb. Mr. Morse exhibited the Japanese archery-glove. It has a filling of wood and pitch in the thumb, which aids in grasping the arrow. He considered this glove the best of its kind.

Our system of three-finger release is certainly as good as any other, and probably is the best. With this system our archers—for instance, some in Ohio—are able to outshoot any Indian, tried by all the usual tests. As to the methods of stringing the bow, the author had not been able to find much uniformity. A number of different modes were exhibited.

Vestiges of glacial man in central Minnesota.

BY FRANC E. BABBITT OF LITTLE FALLS, MINN.

IN the absence of the author, this paper was read by Mr. Upton.

The field of the discoveries detailed in this paper lies on the bank of the Mississippi river, in central Minnesota, about one hundred miles north-west of St. Paul, and within the township and village of Little Falls, Morrison county. In his report for 1877, Prof. N. H. Winchell, state geologist of Minnesota, described certain rudely worked pieces of quartz discovered by him in this locality. The author of this paper describes a discovery of worked bits of quartz in a much older stratum than the one explored by Professor Winchell.

Fragments of sharp, opaque quartz were found by the author in 1879, in a gap or notch, cut by drainage, in an ancient river-terrace, which has an elevation of twenty-five feet above the present river. The gap had been deepened by use as a wagon-track, which has latterly become a highway. Ultimately the source of these fragments was traced, and found in the form of a thin layer, situated from ten inches to two feet above the point in the notch where Miss Babbitt began her discoveries.

The ancient terrace consists of stratified gravel and sand. The layer of quartz-chips extended in a nearly horizontal plane into the terrace, and was partially broken up on the edge where the gap, with its wagon-road, had disturbed a portion. Both the inferior and superior planes of the quartz-bearing stratum were sharply defined: its thickness averaged a few inches, varying a little with the size of included pieces. The quartz-bed rested upon a few inches of sandy soil, which passed downward into a coarse water-worn gravel immediately overlying till. Above the quartz-bed, stratified gravel and sand extend up to the surface of the terrace, which is twelve to fifteen feet higher than the plane of the quartz. The pebbles of the gravel lying directly on the quartz were small well-rounded, and less angular than those of the gravel below. These observations show that the quartz-chips were spread originally upon an ancient surface that was afterward covered deeply by the modified drift that forms the terrace. The quartz-chips and implements discovered by Dr. Winchell were in the upper stratum of the terrace-plain. The two sets of objects cannot be synchronous in deposit: between the periods when they were left there, an interval of time must have passed sufficient for the deposit of twelve or fifteen feet of modified drift.

The specimens are mostly small, and very numerous. Among them are some of a type unknown to the author, of which the most finished have delicate, fragile edges, formed by a single thin leaf of the quartz prolonged beyond the mass of the object in a series of minute, irregular notches. The specimens of different types were found in groups, each of its own type, in this deposit. Some are thus described: 'Axe-like quartzes,' 'rasping-stones,' 'long prong-shaped objects,' 'hammer-stones of different shapes, sharp pieces adaptable as cutting-blades, and

a great many sharp and long splinters.' They are made of many different varieties of the quartz mineral; but the greater part appears to have been taken from quartz-bearing slate in the vicinity. Numbers have evidently been formed from water-worn pebbles. Objects shaped from some special variety or tint of quartz were found generally together in loose groups of two or three to a dozen pieces. Where a piece is of large size, the chips surrounding it are usually much smaller.

Professor Henry W. Haynes of Boston, to whom a collection of the specimens was submitted, has written, that he believes some of them to be implements; many, chips and refuse struck off in the work; many are natural forms, and a few are rolled pebbles. Those which he thinks are implements, he supposes were held in the hand of the workman; masses of quartz were fitted for use by having most of their projections battered off by another stone. He believes, also, that he has found traces of moss or leaves being used to soften the roughness of these implements when held in the hand.

Mr. Warren Upham, assistant of the state geological survey, contributed the following statement on the subject, showing how man could live while the modified drift was deposited, and how relics of his work might be enclosed within that formation. He says, —

"As soon as the ice had so far retreated as to uncover the present valley of the Mississippi river in Morrison county, the deposition of the modified drift, constituting the terrace-plain in which are found the quartz chippings, ensued, during the continued retreat of the ice. It seems very probable, that vegetation and animals followed close upon the retiring ice-border; and that even man, who lived near the Atlantic coast in this closing stage of the glacial period, as abundantly proved by recent discoveries in the drift-gravel near Trenton, N.J., may also have lived here at that time, and occupied the Mississippi valley directly after the ice-sheet retired. While the deposition of the valley-drift at Little Falls was still going forward, men may have lived there, and left, as the remnants of their manufacture of stone implements, the multitude of quartz fragments here described. By the continued deposition of the modified drift, lifting the river upon the surface of its glacial flood-plain, these quartz-chips were deeply buried in that formation. The date of this valley-drift must be that of the retreat of the ice of the last glacial epoch, from whose melting were supplied both this sediment and the floods by which it was brought. The glacial flood-plain, beneath whose surface the quartz-fragments occur, was deposited in the same manner as additions are now made to the surface of the bottom-land; but the flooded condition of the river, by which this is done, was doubtless maintained through all the warm portion of the year, while the ice-sheet was being melted away upon the region of its head waters. In spring, autumn, and winter, or, in exceptional years, through much of the summer, it seems probable that the river was confined to a channel, being of insufficient volume to cover its

flood-plain. At such a time this plain seems to have been the site of human habitations and industry, as shown in this paper. After the complete disappearance of the ice from the basin of the upper Mississippi, the supply of both water and sediment was so diminished that the river, from that time till now, has been occupied more in erosion than in deposition, and has cut its channel far below the level at which it then flowed, excavating and carrying to the Gulf of Mexico a great part of its glacial flood-plain, the remnants of which are seen as high terraces or plains upon each side of the river."

An animated discussion followed the reading of Miss Babbitt's paper. Mr. Putnam referred briefly to the discoveries made by Dr. Abbott in New Jersey, some of which are unquestionably artificial productions, and prove that man resided in that region prior to the last glacial deposit, or, as some claim, between two glacial deposits. The discoveries made here seem to be of the same character as those in New Jersey. Their age belongs to geologists to ascertain. He considered the discovery very important, and the paper one of great value. Rev. Mr. Peet took issue with Mr. Putnam as to the value of the discoveries, and thought, that, if paleotiths had to depend upon such a shallow foundation as was furnished by these alleged discoveries, the matter would better be dropped. He thought there was absolutely no evidence that the specimens discovered by Miss Babbitt were the work of man, and was of the opinion that the whole theory was without any foundation whatever.

A classification of the sciences.

BY J. W. POWELL OF WASHINGTON, D.C.

THIS is an endeavor to classify sciences in the order of the evolution of phenomena, and with reference to complexity. The first group of science, relating to physics, the author divided into molecular, stellar, and mechanical science. In the second group, the biological sciences, he placed botany and zoölogy. In the third group, anthropology, we have psychology, sociology, philology, technology, and philosophy. Geology is a compound of the first group; paleontology, of the second.

The following subdivisions of the third group were suggested: As branches of philology: 1. sign language; 2. spoken language; 3. written language. Under technology: 1. activital; 2. regulative; 3. ethics. Under philosophy: 1. mythology; 2. metaphysic; 3. scientific. Technology is also either industrial or aesthetic. The author explained in further detail the reasons for this order of classification, and the relations of the members of different groups to each other.

List of other papers.

THE following additional papers were read in this section, some of them by title only: An ancient village of the emblematic mound-builders; caches guarded by effigies; effigies guarding the village and sacrificial places not far away; high places connected

with ancient villages; The religious structures common to villages in prehistoric time, by *S. D. Peet*. An abnormal human skull from a stone grave in Tennessee; A new stand for mounting skulls, devised

by *E. E. Chick*, by *F. W. Putnam*. Accidents, or mode-signs of verbs in the Iroquois dialects; Studies in the Iroquois concerning the verb 'to be,' and its substitutes, by *Erminie A. Smith*.

PROCEEDINGS OF SECTION I.—ECONOMIC SCIENCE AND STATISTICS.

ADDRESS OF FRANKLIN B. HOUGH OF LOWVILLE, N. Y., VICE-PRESIDENT OF THE SECTION, AUG. 15, 1883.

THE METHODS OF STATISTICS.

I INVITE your attention to a few thoughts upon the *methods of statistics*—using the term 'statistics' in its broadest sense, as a 'statement of facts.'

The subject naturally divides itself into two distinct operations,—the collection of the data from which information is to be obtained, and their classification in a manner that shall without error, and with the least labor, present the results in a form most convenient for use.

Commencing with the first of these,—the collection of facts,—it would be needless to remark, that every thing depends upon the simplicity, accuracy, and completeness with which they are obtained, and that by no subsequent operation can their errors be eliminated, or their deficiencies satisfactorily supplied.

It may be remarked, in general, that no intelligent person, business firm, or corporation, can safely begin any enterprise,—nor can any government, from the lowest municipal to the highest national form, undertake any measure with prudence,—without first knowing all that can be ascertained beforehand concerning it.

In private business, inquiries are naturally made as to the cost and the profits. If it requires the use of a raw material, the parties will endeavor to make themselves sure as to its abundance,—the probability that the supply will be maintained,—or, if it be of limited amount, the quantity, and the time that it will hold out. They will need to know the changes that may happen in amount, quality, and cost; and similar inquiries will be made as to the expenses that may be incurred while in their hands,—the chances of loss, or of change in value,—and, finally, the extent of the demand for whatever may be the product of their skill, industry, and investment, its probable permanence, and its tendencies to change.

These questions, being well considered in the beginning, will enable the careful operator to avoid losses from imprudent investment, from over-supply of the markets, or from the depression of receipts below the limits of cost.

By a train of reasoning analogous to this, those intrusted with the government of towns, cities, or states, may determine as to how far the cost and maintenance of public enterprises will be justified by the results; but with this difference, that the benefits or profits, instead of being measured by a money value, are often to be found in an advancement of

the public welfare, and in the security, convenience, and prosperity that may ensue.

But, whether in private enterprise or public undertaking, we may attribute success alike, in both, to an attentive notice of the facts and the circumstances upon which they depend; and, if loss or failure follow, the reasons may very generally be traced to ignorance or inattention as to the facts and probabilities that should have been known beforehand.

These thoughts lead us directly to the point we are first to consider; viz., How shall the knowledge of the required information be obtained? In the primitive way (and for a small business this may be the best one), the person will, from his own observation, 'look over the ground,' and consider the various points to be taken into the account. He will make inquiries of others, as to the supply, demand, prospects of competition, and the like; and thus accumulate a certain amount of information, upon the extent and accuracy of which, his success or failure will in a great degree depend.

Advancing a step farther, we find, in most great industries and interests of the country, that those in the same business or pursuit, whether in the arts or sciences, or in financial operations, however they may be influenced by local rivalries or petty jealousies, are constantly tending to the formation of associations or societies, for the advancement of their common interests. They meet for the discussion of methods by which expenses may be saved, or profits increased. They inquire of one another as to their experience or observation upon doubtful points. They seek to gather light and aid from science, to stimulate and reward invention, and to excite rivalries in the comparison of improved products. They discuss financial and national questions that may affect their welfare; and not unfrequently they appoint committees or agents, from their own number, to gather statistical facts and details for their own use and guidance.

We consider the information thus obtained, as deserving high rank in point of accuracy. It is chiefly taken from records, without a motive for concealment or evasion, and with a full knowledge that self-deception and loss would result from error, whether above or below the truth.

From this combined experience, each member who participates obtains a standard for comparing his own results with the general average. He cannot afford to fall below it, and he has the strongest motives for reaching the highest limits that have been reached by others.

Still these statistics, however accurate they may be, are necessarily special, and often technical in their nature. They cannot be compared with those

of another business, and may be incomplete within themselves, as naturally relating to methods, rather than to financial details. They might show *how*, rather than *how much*. They will seldom contain a balance-sheet of profit or loss, or any thing that would advance the fortunes of a rival in business, or reveal the secrets of an unprofitable enterprise. We must receive them as we find them, — good only as far as they go.

Besides these associated business inquiries, prompted and guaranteed by self-interest, we find various others, voluntarily undertaken with reference to particular subjects, often for the promotion of a moral, religious, benevolent, educational, or political object, and ranging in value all the way between the accuracy of statements taken from records, or gathered by faithful inquiry, by chosen special and zealous agents on the one hand, and the random conjectures carelessly returned by those who know but little, and care still less, about the subject of inquiry, on the other. It would be wholly impossible to assign a scale of value to statistics thus obtained, where every thing depends upon the circumstances of the case, and the accuracy of information on the part of those who make returns, — the fulness with which they are reported, and the care with which they are combined.

We have another class of non-official statistics collected and published by private enterprise, for the information of particular trades or professions, or for use by the general public; their reputation and success depending wholly upon their accuracy, and being brought to the test of local and personal knowledge every day and everywhere, we may naturally expect them to be as accurate as they can be made. In this class, we may include directories, trade and market reports, financial transactions, and the current commercial statistics generally.

There may be instances where they are tainted with a suspicion of private or speculative motive: but such is the vigilance of rival enterprise, that detection will quickly follow; and an exposure would at once degrade a reputation for independence and impartial statement, to the rank of a private job for a speculative end.

Exhibits openly made, for the avowed purpose of presenting the favorable side of a business enterprise, may be taken for what they are worth, and are often trustworthy; but, when concealed under a false pretence, they deserve suspicion, and, when exposed, they generally injure the interest that they represent.

The best of these statistics are taken from records, and are entirely correct; others are collected by special agents, and should be approximately near the truth; and there is still another class, made up from the estimates of those supposed to know the facts, and which must wander more or less from the actual conditions that they attempt to represent.

It may be said of all of them, that their greatest value is for present use. They quickly pass by, to give place to the next issue, and remain only as historical records; but, as such, they still afford a most valuable means of comparison between the present and the past, and become landmarks of progress, ever instructive to

those who may be seeking to trace the origin and growth of our industries and our resources; and now and then they are recalled as precedents, where new questions arise, under circumstances deemed similar to the past.

We will next consider some points relating to inquiries undertaken by authority of government, either for the intelligent discharge of its own functions, or for general information, the good of its citizens, and the advancement of knowledge among mankind.

We may, in general, remark, that nothing can be properly done, in the machinery of government, without leaving its record. If money or property is received, there is an entry; if a payment is made, or if property is issued, there is also an entry, and a receipt to prove it. In short, the whole theory of our government involves the necessity of a record of every official transaction; and it is only in cases of intentional fraud, or gross neglect, or unavoidable accident, that the history of every public act cannot be traced from these records.

A record, to be trustworthy, should be made at the time of the transaction, and while all the facts as to time, subject, and amount, or other points of statement, are fresh in mind. Nothing should be trusted to the memory, and for record at a more convenient season. It should be concise, and easily understood, and may often be very greatly assisted by tabular arrangement.

The summaries of these records, as published by the government, are, we believe, with few exceptions, entitled to great confidence, as far as they present transactions done by authority, or passing under the notice of government agents.

We may classify the official statistics of the government under the following heads:—

First, Summaries of current business, published annually or at shorter intervals.

Second, Periodical inquiries made at wider intervals, as in the census, and requiring special agencies for their execution.

Third, The inquiries made by experts, or by special commissions or agencies created for a particular purpose. This class is sometimes associated with one or the other of the preceding.

Taking from among these classes the census, as one of the most important, let us notice some of the methods by which it has been taken.

The earliest returns that I have found, in colonial times, were made by sheriffs and constables. At a later period, the national census was for a long period taken by the marshals of the district courts, or their deputies, — officers whose duties are quite analogous to the former; and this practice of assigning the task to sheriffs still prevails in several of the states.

In many other cases, assessors discharge the duty. In New York, before 1855, special agents were appointed by local authorities; and, commencing with that year, they have since been appointed by the secretary of state. The appointing power has been vested in state boards, in boards of county commissioners, and in the judges of inferior county

courts. Assuming what I think all will admit, that census inquiries should be made entirely free from any suspicion that some tax or some personal liability is to be incurred, it is evident that an assessor cannot question an ignorant man about his property and his crops, without exciting his fears that some tax is to be laid. The sheriff or the constable seldom makes a professional call, except to serve some papers or make an arrest. There is, therefore, a strong reason for appointing persons who are to make the census inquiries their only business, and for making it widely known that there is no taxation, enrolment, or other liability incurred by giving full and true returns, and that there is no sectarian or political end to be served by the inquiry.

This excellent end is now well enough secured under the national law, and in several of the states. They have a still better method in Great Britain, where a system of registration of births, marriages, and deaths, has its districts and its agents under constant organization, and to which, once in ten years, the census can be assigned, without creating new offices. In Sweden, where a system of registration, including also a record of change of residence, is in charge of the parish-clerks, they take a census whenever they choose to post the books, without any special inquiries being made, more than what these records contain.

In the national census before 1850, — in New York before 1855, — and in some of the states still, each family had one line upon the blanks; and the number of persons of different ages, sexes, and colors, was entered in columns provided. The limit of classification was of course restricted to these columns; and, although the totals of each class were easily obtained by adding, the results were meagre and unsatisfactory.

The change that allowed a line for each name, one column for the exact age, and other columns for native country, profession or occupation, etc., while it simplified the labor of taking, allowed ample field for classification; and it made it necessary to employ a large force of clerks, in a central office, for the reduction of the returns for publication.

By a method now generally used in Europe, the census is taken upon 'householders' schedules,' which are distributed one to each family, some days beforehand, filled out by the head of the family, and collected upon *one day*. The only instance in which this has been done in the United States, within my knowledge, was in the District of Columbia, upon the 11th of November, 1867. This census was taken by the metropolitan police, under my own direction, and with entire success. It was attempted in the city of Baltimore some months afterwards, and failed, apparently from want of proper management on the part of those in charge.

For all kinds of official inquiries, relating to business, as well as to personal statistics, I think the true and proper method is, by means of *special blanks*, carefully prepared, simple, and fully explained. These should be distributed some little time beforehand, and should be taken up, if not in one day,

within a short period of time, but with reference to a given day. The chief difficulty to be encountered is the illiteracy of those who should fill the blanks; but in the District of Columbia, which in 1867 contained a large number of colored families, but recently freed from slavery, the blanks had been, in almost every case, filled out by some one to whom they had been carried.

In following our subject, — the 'methods of statistics,' — we may notice some points in the condensation and arrangement of facts that may be of interest.

With a vast amount of information before us, as, for example, in the returns of a census, let us consider what is to be done, and how it can be done with the least labor and greatest certainty. After inspection to make sure that the work is all together, in proper order and condition, it will be found that several distinct operations are necessary, in preparing the results for the press. Columns of figures must of course be added, and carefully revised. As the totals of several sheets will often be consolidated into one sum, it is best to use spare sheets of the same schedule for entering the totals of pages, so that these partial totals can be easily combined. It is always a good practice, where long columns, of many figures in each, are to be entered for adding, to provide paper with narrow vertical ruling, that shall allow of but one figure in a space. In cases where the first two or three right-hand characters are generally ciphers, they may be left out altogether, the significant figures only being entered in their proper places. It saves a little time and labor, and does not lead to error.

Where a great amount of statistical material is reported, — as, for example, the names in a census, — the blanks should always be plainly divided by horizontal and vertical lines, *printed in preference to ruled*. The horizontal lines should be numbered from the top downward, upon both margins. This numbering is the more important where an entry is carried across to another page. Each line should contain but one entry, and there should be, if possible, no blank lines except at the end. Then, with a little multiplication-table at hand, showing the number of lines in a full sheet, and for each number up to the highest that are likely to be found in a return, the totals can be rapidly and accurately ascertained, as follows: The number of sheets is first counted on the back edge, and the number of entries they should contain, if full, is set down. Then, by glancing over each page separately, it is easy to notice whether there are any lines with two entries, any blanks, or any lines in excess. The deficiencies are set down in one column, the excess in another, and their difference is added or subtracted, as the case may require, when the true sum is at once found. This operation, which is the first thing done, should be repeated by another person; and, when found to agree, it should be kept as a test-number for verifying the accuracy of much of the work that is to follow. In measuring parts of pages, a scale made of a strip from the margin of a blank schedule, and pasted upon a card, will save all labor of counting.

In statistical labors, where the same returns afford

material for a considerable number of deductions, — as, for example, the population sheet of the census, — it is generally best to take *but one thing at a time*. Thus, the ages, professions, nativities, civil condition, etc., should be taken by separate operations, and not two or more at once. There is not, however, the least need of confusion in keeping the subdivisions of these subjects, in two or four classes, — as, for example, ages by sex and color, — by a simple arrangement of heavy and light horizontal lines upon the tally-sheet, and a little practice in its use.

There is much to be gained, both in time and accuracy, by a proper arrangement of a tally-sheet. The grouping together of tally-marks, by making four down and one across, so as to divide the work into groups of fives, is so natural and obvious a method, that few who have had occasion for this kind of work could have failed to adopt it. By an arrangement which I have used to a large extent in census work, I have had my tally-sheets printed off into squares, so that each compartment should receive one group of five, and no more. Then, by a series of numbers with a common difference of five, printed across the top of the sheet, at the head of each vertical column, the number of tally-marks in a horizontal row can be known at once, by glancing along the vertical column containing the last full group of fives, to the number printed at the top, and then adding the marks in excess, but less than five, in the next compartment. This saves all counting, and a considerable amount of time. There is also an advantage, on account of the eye-sight, in having the tally-sheets of some other color than white: a neutral tint might be best, but I have found common manilla paper answer every purpose.

Plans have been proposed for using cards of different sizes and colors, properly inscribed or numbered, as counters, for classifying a variety of facts, forming together a definite whole. By using colors, the eye becomes, without mental effort, a guide to the hand, in their distribution into piles or cells in a case; and, when the work is done, their number may be accurately known by weighing, or by measuring the height of each pile. Those of different sizes could be separated by mechanical devices, without handling, and, by a little practice, without liability to error.

It may be said generally, that the chief, indeed the only real, difficulty, in the preparation of statistical data, consists in getting the facts correctly. There is nothing in the operation of a central office that needs to involve error; or, if an error is committed, there should be no difficulty in tracing it to the clerk who is responsible for it. An efficient way to secure accuracy in work would be, to make a money-charge against the clerk who commits an error, to be paid to the one who finds it. I believe that something of the kind is done in some of the statistical offices in Europe, a class of revisers being employed, who are paid by the fines thus imposed upon the careless.

With respect to statistics obtained by circulars addressed to persons supposed to have the information desired, we have every grade of value, from good to good for nothing. The result depends upon many cir-

cumstances: as, for example, whether the person making the return is paid, or is under some obligation to, or expects some favor from, the person or office making the inquiry; whether the inquiry can be answered by reference to a record, or by some research more or less conveniently made, or is to be supplied from personal opinion, and a general knowledge of the subject; or, finally, whether the question can be answered by any thing better than a guess, by one who knows perhaps very little about it.

I would hold it to be the general rule, that where the inquiries are few and simple, exact as to their object, and, if they refer to a record, exact as to time and subject, and especially if they can be returned upon the same blank, and without expense for postage or otherwise, a very large percentage will be answered without a second application. A repeated call would probably bring a third or a half of the remainder; but there will be, now and then, one who will fail to reply, unless under official or personal obligation to do so.

We have thus far considered the dealing with statistics that have been gathered from the whole of a given field of inquiry: there are other methods that deserve notice, and the first of these is that 'by samples.' A portion of some whole is carefully studied, and the results obtained are deemed applicable to the entire field.

The French statistician Moreau de Jonnès has given some instances of this method, as applied in times past, by persons who had acquired eminence, and whose work gained confidence; and very properly asks, 'What is such work worth?'

Vauban, distinguished as a military engineer, at the beginning of the eighteenth century, wishing to know the agricultural production of France, and the revenue it would yield, resorted to a method which would appear strange enough now, but still may be called ingenious. He attempted to reach his object by taking an exact account of the production of a square league, reckoning the arable land, vineyards, pastures, and woodlands, with their products in quantity and value; and then, by the simple "rule of three," he said, "as 1 is to 25,000, so is the result to the whole of France."

The English agriculturist, Arthur Young, sought to ascertain the proportions of meadow-land, mountains, and the like, in France, by cutting up a map by lines following these features of the surface, and weighing the parts.

In 1790 Lavoisier, distinguished in science, and for this reason consulted by the national assembly upon a question of imposts, found no existing data that applied to the internal resources of the country, until he himself supplied them, by a method that is now altogether neglected in statistical researches. He proposed to ascertain the number of ploughs in the country, and from this to calculate the quantities, production, and consumption of agricultural crops.

In 1784 M. Necker, the distinguished statesman, deduced the population of France from an assumed percentage of the birth-rate; and this was taken for a census!

But coming down to a much later period, we find a remarkable application of the law of induction in a work upon the industries of France, by the minister Chaptal. He presents agricultural tables, which have been received with great confidence, since they bear the appearance of official statistics, and were executed under the Empire. His tables are found to have been computed, without acknowledgment, from a statement addressed by M. Hennet, director of the cadastral survey, in 1817, at a time when not more than a seventh part of this work had been finished. The other six-sevenths were obtained by a simple multiplication of the finished part.

Many years ago, a 'distinguished statistician' published, with great apparent precision, the yield of potatoes in France. There had been no official inventory taken; but when one came to be made, some time afterwards, it was found that this deduction had been obtained by multiplying the yield of a single commune by 37,000, the number of communes in France.

These examples might be multiplied indefinitely; and we need not cross the Atlantic, nor go far back in time, to find them. There is scarcely a day, but that we see passing through the newspapers, estimates, deductions, and statements, that have no more solid foundation than those that we have cited. Nevertheless, we must not wholly disregard the inductive method in statistics: there are many cases in which we can get nothing else.

The chemist must analyze the soils and the ores from samples. In every operation of testing the quality and the value of any commodity whatever, we must select from the material before us what appears to be the average quality. And so of statistics generally: if there is no actual and general inventory made, we must collect from what is deemed a fair average, and, from these data, obtain such conclusions as they afford. The result in this, as in every thing, will depend upon the intelligence and honesty of the person who makes the estimate, the extent of his opportunities, his experience, and his skill.

Returning to the field of exact statistics, we may remark, that we can never have an accurate census of the population until we have a thorough and uniform registration of births, marriages, and deaths; a measure which this association undertook to promote, more than a quarter of a century ago, but which has not made successful progress.

We cannot have a faithful statement of the industries, without a record kept of the production, the consumption, and the cost of operation. This is already done by most of the important ones, as an incident of business; but we lose the advantages by the hurried manner in which the official inquiries are made. Yet upon these returns we rely for all that is collectively known about them.

It follows, that, until we can realize these desirable features, the best we can expect is, to afford more time for previous preparation, by submitting beforehand the questions that are to be answered; which can only be done by the aid of 'householders' schedules' for population, on 'special blanks' for each of

the industries, or other subjects, that come within the range of inquiry.

It was my intention to dwell at some length upon the illustration of statistical facts by graphic methods; but time will not permit, and opportunity for full preparation has not been found. For more than thirty years I have been accustomed to note down the principles involved in these methods, whenever, in the course of a wide and varied range of opportunity, a new one was found; and it has been with me a cherished intention to present the whole subject in a systematic form.

We may concisely state, that graphic illustrations, using lines, areas, or angular spaces, often supplemented by colors, may be employed for representing either—

1. *Quantities*, with or without reference to time.
2. *Time*, in recurring, interrupted, or progressive periods.
3. *Direction*, or *relative position*; and
4. *Intensity* or *force*.

In general, but two elements can be clearly presented at once; but by a skilful use of different colors, or kinds of lines, subjects of the same nature may be admirably compared, and the relations of cause and effect not only illustrated, but even discovered and proved. It is often admissible to introduce subjects having dissimilar notation,—as, for example, degrees of temperature, and height of barometer,—in the same drawing; but in these cases each must have its own scale, and, in a general way, every diagram must have a scale for every element of the subject that is represented, either expressed or implied.

Quantities may be shown either as they exist at certain periods of time, or as they form parts of a general total; and they may be presented so as to exhibit successive subdivisions, down to any desirable degree. If the divisions of a general total do not require subdivision, they may best be shown by angular spaces, as sectors, which together make up the whole of a circular area. If the divisions have some qualities in common, the shades of color may be of different intensity, significant of the degrees of quality that may exist. But where there are successive subdivisions, or *parts of parts* of a whole, there is no way so exact as by means of rectangular areas, which may also be shaded in different tints, as well to separate them one from another as to show differences of intensity or degree.

In both of these methods, as well of angular spaces as of rectangular areas, we can only show quantities as they exist at a given point of time. We catch, as it were, the conditions, as does the light, the image in a camera. They admit of no such thing as motion or change; but these changes may often be strikingly represented by a series of diagrams, presenting the conditions at different periods of time.

Where time and quantity are combined, we have an easy and striking means of illustration; and in this the time may be in recurring periods, such as the hours of a day, or the months of a year, or it may be progressive, as in a series of years.

For the recurring periods, I think there is nothing

so convenient and instructive as the *circle*, in which the quantities are measured along the radii, from the centre as their base. The entire radius may sometimes represent the whole of that of which these partial measurements are a part.

For a progressive series, the ordinates representing quantities should be measured from a level base-line, and the scale of graduation shown upon the side margin, while the time is measured from left to right by a scale along the upper margin.

For simple comparison, a series of bars or lines, measured from a common base, and either horizontal or vertical, is a convenient and striking mode of illustration, and has now come into very common use.

A rectangular area, with parallel divisions, amounts to the same thing as a line; but with this difference, that a secondary subdivision may sometimes be represented with great effect.

Having thus stated some points in reference to graphic illustrations upon a true principle, I should not leave the subject without a word of censure for some that are false. I will specify, particularly, such as attempt to represent comparative quantities by *concentric figures*, such as circles or squares. The eye has, in these cases, no means of just comparison; and they are very apt to mislead, where they are intended to instruct.

The same objection may be made against similar geometrical solids; for, although they may be literally true, their contents being to each other as the cubes of similar lines, the eye does not readily see the difference. It would be better, in such cases, to use cylinders or prisms of the same base, but proportioned in length to the quantities that they represent.

PAPERS READ BEFORE SECTION I.

Life-insurance and self-insurance.

BY ELIZUR WRIGHT OF BOSTON, MASS.

THIS subject has been a favorite theme with Mr. Wright for several years. His ability as an actuary is acknowledged; and his theory on this subject has at least the merit of disinterestedness, so far as insurance-companies are concerned. Without going into the technicalities and mathematical considerations that must be met in a thorough review of Mr. Wright's theory, its object may, perhaps, be stated correctly in a few words. A reserve is accumulated by the practical workings of life-insurance in a well-regulated company, which is more than sufficient to meet the claims upon it as fast as they mature. The usual system divides that reserve, less the amount which the company withholds as a surplus for extraordinary emergencies, among the policy-holders. Mr. Wright takes the view that each policy earns, during its continuance, an ascertainable part of that reserve. He supplies the means for determining what this part is, for each policy: of course, it is a matter of calculation for each. He denominates this part of the reserve, or surplus, the 'self-insurance.' By his system it is possible to ascertain at any time how

much this self-insurance on a given policy amounts to, or how much it will amount to at any future time, if kept in force. Mr. Wright believes that the self-insurance is the property of the policy-holder; and that, if not payable to him on demand, it should at least be applicable for a renewal of the policy to prevent forfeiture.

The increase of the colored population of the United States.

BY C. S. MIXTER OF WASHINGTON, D. C.

It is frequently asserted that the colored population of the United States is increasing more rapidly now than it did prior to 1861. The large apparent increase shown by a comparison of the census-returns of 1880 with those of 1870 seems to justify this opinion; but the results of investigations made by the superintendent of census in South Carolina and Mississippi show that the census in 1870 was seriously defective in this respect, while that of 1880 was very full and complete. The accompanying statistical table presents the returns of these people according to each U. S. census from 1840 to 1880, and gives the numbers reported from the South in detail. These results seem to indicate that they are not increasing as rapidly as formerly. The burden of supporting their minor children, and their disregard of the rules of health, seem to furnish additional reasons for thinking that their future rate of increase will be less than it has been heretofore.

Resided in	1880.	1870.	1860.	1850.	1840.
Alabama	600,103	475,510	437,770	345,109	255,571
Arkansas	210,666	122,269	111,259	47,708	20,400
Delaware	26,442	22,794	21,627	20,363	19,524
Dist. of Columbia .	59,596	43,404	14,316	13,746	13,055
Florida	126,690	91,689	62,667	40,242	26,534
Georgia	725,133	545,142	465,698	384,613	283,697
Kentucky	271,451	222,210	236,167	220,992	189,475
Louisiana	483,655	364,210	350,373	262,271	193,954
Maryland	210,230	175,391	171,131	165,091	151,815
Mississippi	650,391	444,201	437,404	310,808	196,577
Missouri	145,850	118,071	118,503	90,040	59,814
North Carolina . .	531,277	391,650	361,522	316,011	268,249
South Carolina . .	604,332	415,814	412,320	393,944	335,314
Tennessee	403,151	322,331	283,019	245,881	188,583
Texas	393,383	253,415	182,921	58,538	-
Virginia	631,616	512,841	527,763	526,861	498,829
West Virginia . .	25,886	17,980	21,144	-	-
Other States . . .	481,540	341,127	226,219	196,570	171,557
Total U. S. . . .	6,580,793	4,880,009	4,441,830	3,638,808	2,873,648

Oyster-farming in Connecticut waters.

BY H. C. HOVEY OF NEW HAVEN, CONN.

AN explanation of the difference between seed oysters and those fit for market gave the author occasion to mention that 'saddle rock' oysters in their best edible condition were six or seven years old. A history of Connecticut experience and legislation in relation to oysters was given in detail. There are now 325,000 acres of disposable space for oyster-beds, and 100,000 are occupied. The area of the natural beds is only 6,000 acres, and this furnishes

the seed for new beginners. The present expansion of oyster-farming is due to the use of steam-power in gathering the harvest.

The first thing done on an oyster-farm is to stake it out into sections, and then the bottom is examined. The next step is to scatter oyster shells over the farm, and the oyster spawn is scattered. After this, in some muddy localities, small trees, mainly birch, are thrust into the water, in a standing position; and the young oysters set on these trees. The spawn is cast out from June until November, and for a few days the young oysters swim everywhere they please, leading a happy life for a brief period. Shelling begins about June 15, and ends about Aug. 15. When the oysters fill the trees, the latter are pulled up and cleaned off. From one acre of bushes, 1,000 bushels of oysters have been gathered in one year. The oysters set on anything which is clean. They had been found on old boots, old wrecks, and a pair were found on an old padlock. Oyster-farming was not profitable every year; one firm having lost \$20,000 by the ravages of the star-fish in one bed, and another firm \$100,000 in two years from the same cause. Oysters were formerly imported, but are now exported in immense quantities.

The German carp, and its introduction into the United States.

BY C. W. SMILEY OF WASHINGTON, D. C.

THE United States fish-commission, he said, had some years ago imported from Germany thirty or forty pairs of this fish. They were placed in breeding-ponds in Washington, and have increased many-fold, the number spawned this year being 400,000. The carp is naturally a warm-water fish, and in the waters of the southern states grows with astonishing rapidity, and to great size. They will also do well in the cold water of the north, even in Minnesota. Nearly every state and county in the United States has a fish-commission, and they are all propagating carp. It has also been taken up as a private speculation, and carp are sold for breeding-purposes as high as \$5 per pair.

The carp roots about in the mud for aliment, and much resembles poultry in its manner of getting food. Carp aged three years are often found to weigh twelve to fifteen pounds, and a gain in weight of four pounds has been observed in a carp in one year. The carp is sluggish; while trout, bass, and other lively fish frisk about, and do not fatten so fast as the carp. Experiments have shown that female carp spawn at the age of one year in southern waters, at two years in colder waters, and in the extreme northern waters of the United States at three years. Other fish, turtles, muskrats, snakes, and even birds, eat young carp. A bird shot in Washington recently had in its stomach the heads of seventy-nine young carp. The U.S. fish-commissioner recently sent out requests for information about carp experimented with in this country; most of the replies placing the carp on an equality with trout, bass, and shad as a food fish, while a few classed them with pike, and a very few said they had a mud-

dy taste. The carp is the best pond fish yet known, and in a very small pond will thrive well, so that families may easily have their own fish-garden if they have enough water to make a permanent pond. The carp is a very hardy fish for shipment, requiring little water to keep alive in. The U.S. fish-commissioner is giving away carp, sending them by express to any point, the receiver paying express charges. The fish will thrive on table-refuse and almost any thing edible. Carp can be kept in winter in a tub in the cellar, the water requiring to be kept fresh. Care should be taken to keep poisonous substances out of carp-ponds, and too much food should not be thrown in. In cooking carp, thorough cleansing is needed; and frying should be done in hot pans and hot grease.

As to the economics of this subject, Mr. Smiley said that fish-culture was more and more becoming a part of the farmer's occupation, and thought that, not very long in the future, most of the farmers of the country would have little fish-ponds in their door-yards, both as a method of obtaining food and as an ornament to the homestead.

Cable-cars for city passenger traffic.

BY E. T. COX OF NEW HARMONY, IND.

PROFESSOR COX, though devoted to geology, has always taken a kindly interest in schemes for industrial advancement. In the present paper he describes the success of the cable system as a substitute for horse-cars; and urges its general adoption, on the ground of its convenience and comfort to humanity, as well as the diminution of suffering to the horse. Some of the collateral statistics presented in the paper are interesting; e.g., the figures given by Mr. Moody Merrill, chairman of the horse-car railroad convention held at Boston last March: "There are in the United States and Canada 415 street-railways, giving employment to about 85,000 men, 18,000 cars, and 100,000 horses in daily use. These horses consume 150,000 tons of hay, and 111,000,000 bushels of grain. 3,000 miles of track represent an invested capital of \$150,000,000. The number of passengers annually carried is 1,212,460,000. In the city of New York there are 110 miles of horse-railway, and 11,866 horses are used to operate them. The horses, together with their harness, expensive lands and stables, feed and grains, make the operating expenses, by including interest, \$5,104,596.79 per annum. The average life of the street-car horse in New York is less than three years."

The paper quotes an opinion of Gen. W. Sewell of New Jersey, a practical railroad engineer, who prophesies that, within ten years, the cable system will supersede horse-cars on every considerable street line. The great advantage of the system is its applicability to very steep grades. The paper states, in respect to the most vital question to capitalists, that the cost of the plant in the cable system is shown to be about \$70,000 per mile of roadway. We have heard it recently stated, in other quarters, at \$120,000; but perhaps one estimate applies to single and the other to double tracks. This makes it, at best, some-

what expensive as an experiment; and that is the light in which it is regarded by many horse-railroad managers at present.

Improved method of spraying trees for protection against insects.

BY C. V. RILEY OF WASHINGTON, D.C.

THE paper gave a summary of results obtained from experiments made during the past two years at the U. S. department of agriculture. An ordinary barrel is used as a reservoir, in which is inserted a force-pump with automatic stirrer. A long rubber hose extends from the pump, and is attached to the spraying apparatus. The nozzle has been called the cyclone or eddy nozzle; its action carries out new principles of spraying. It is a shallow, circular, metal chamber, with two flat sides, in the centre of one of which is a small circular outlet. The fluid is forced into this chamber tangentially, producing rapid rotation, and a spray which is easily regulated from a mist scarcely visible to a strong shower. This nozzle is adjusted to the end of a bamboo rod (of varying length, according to requirement), through which the rubber hose has been passed; or several nozzles may be attached, in different positions, to the sides of a stiff metal tube, sufficiently slender to be handled by the operator, and thrust among the branches of the tree. By these means, trees from twenty to thirty feet high can be rapidly sprayed without the use of a ladder. The substances used are either London purple, one-half pound, and flour, one pound, in from forty to fifty gallons of water; or Paris green, one pound, to the same amount of flour and water; or petroleum emulsions made as Professor Riley indicated at the last meeting of the association.

Enhancement of values in agriculture by reason of non-agricultural population.

BY J. R. DODGE OF WASHINGTON, D.C.

THE paper begins by showing that national industry is prosperous in proportion to its diversity. The productions of agriculture would be unsalable if all the people were agricultural producers. A civilized nation, with the smallest proportion of non-agricultural workers in it, will be low in the scale of prosperity: with the largest proportion of non-agriculturists consistent with proper food-supply, the nation will be most prosperous. To a great extent, this is true also of the subdivisions of this country. It may be illustrated by the statistics of geographical sections that embrace groups of states, or by comparison of individual states. The author is even prepared to show, that, in a partly agricultural community, the increased employment of labor in industries that are non-agricultural stimulates improvement, compels higher culture, and makes the products of land, and the land itself, more valuable. Such is the theory. In support of it, the author adduces striking facts, obtained by compilation from U.S. census returns of 1880.

The states and territories are grouped for this comparison in four classes, which are thus designated:

first class, having less than 30 per cent of agricultural workers; second, having over 30 and less than 50 per cent; third, having 50 and less than 70 per cent; fourth, having over 70 per cent, *i.e.*, being almost exclusively agricultural states.

Classes.	No. of states and territories.	Acres.	Value.	Value per acre.	Per cent of workers in agriculture.
First class . .	15	77,250,742	\$2,985,641,197	\$40.91	16.59
Second class .	13	112,321,257	3,430,915,767	22.21	40.12
Third class .	13	237,873,040	3,218,108,970	13.03	58.85
Fourth class .	6	108,636,796	562,430,842	5.28	77.46

In the first class are Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania in the east, and some of the mining states and territories of the west, diverse in many points, yet alike in the fact of a large non-agricultural population. This class has only one-sixth of the population in agriculture. The fourth class consists of North and South Carolina, Georgia, Alabama, and Mississippi. It has nearly four-fifths engaged in agriculture, on lands worth only an average of \$5.28 per acre. The states having only two-fifths in agriculture have farm-lands valued at \$22.21 per acre, while those having nearly three-fifths in agriculture have lands valued at \$13.03. These figures speak for themselves, and scarcely need comment from the author.

When individual states are compared, the results are equally marked. The author compares pairs of states, — Virginia and Pennsylvania, Kentucky and Ohio, Iowa and Illinois, — as follows (for convenience we place these comparisons in tabular form): —

Items of comparison.	Virginia.	Pennsylvania.	Kentucky.	Ohio.	Iowa.	Illinois.
Per cent of agricultural workers	51.41	20.68	61.67	39.97	57.46	43.65
Value of farm lands per acre	\$10.89	\$49.30	\$13.92	\$45.97	\$22.92	\$31.87
Wages of agricultural laborers per annum .	180.00	431.00	199.00	394.00	1	467.00

Similar computations give figures for the State of New York not widely different from those for Pennsylvania. The average value of farm-lands per acre in New Jersey is greater than in any other state, *viz.*, \$65.16: this is owing to a position between two great city markets, with proximity and easy access to both. Her percentage of agricultural workers is only 14.92; their average annual wages are \$501. It will be seen that the wages of agricultural labor are subject to the same law. If computed for the first table in this paper, the wages per month of the agricultural

¹ The annual wages of agricultural labor in Minnesota are \$376.

laborer would be found, for the first class of states, fully \$25; for the second, nearly \$25; for the third, less than \$20; for the fourth, about \$13.50.

An application of the same test to the value of annual production for each man engaged in agriculture brings equally interesting results in the following table:—

Classes.	No. engaged in agriculture.	Value of products of agriculture.	Value per capita.	Per cent of workers in agriculture.
First class . .	1,060,681	\$484,780,797	\$457	16.51
Second class . .	1,566,875	616,850,959	394	40.12
Third class . .	3,017,971	786,681,420	261	58.85
Fourth class . .	2,024,966	325,099,388	161	77.46

The states with less than 30 per cent in farm-labor realize nearly three times as much per man as those which have over 70 per cent in farm-work. In other words, one man in the first class realizes as much as the three men who are competing with each other, having little outlet for surplus production. Three brothers in Alabama, laboring through the year, get as much for their aggregate produce as one farmer receives in Pennsylvania, simply because that farmer has a brother engaged in manufacture and another in mining. It is because in one case there is a market for one product only, thousands of miles away: in the other, there are markets at every door.

It appears evident that the proportion between agricultural and non-agricultural population is a measure of the values of the land, of the production, and of the labor of the farm. These values are rapidly enhanced by the increase of non-agriculturists. This is the lesson of the most authentic statistics of our own and of other countries.

A new system for the treatment of sewer-gas.

BY T. E. JEFFERSON, HUDSON, WIS.

IN this paper, which was well illustrated by diagrams, special reference was made to a series of important inventions which of late have attracted much attention both in this country and Europe. This system chiefly consists in making sewers approximately air-tight by sealing the sewer inlets so as to admit sewage, but exclude the air; making pipe connections between sewers and buildings, and different heating-apparatus arranged to admit the in-flow of atmosphere and the products of combustion into the sewer, and, at the same time, prevent the back-flow of gas; when by the connection of a powerful suction apparatus with the sewer, near its outlet, the removal of sewer-gas and smoke from furnaces and fires, and the thorough ventilation of buildings, is positively effected and regulated as desired.

By employing mechanical force for creating draught for fires, the large percentage of heat heretofore required for this purpose is retained, effecting a corresponding saving in the consumption of fuel.

The main portion of these important discoveries, including the removal of sewer-gas, and the positive means of ventilating buildings and carrying the vitiated atmosphere and poisonous vapors away from contact with the inhabitants, was recently made by Hon. John Comstock of Hudson, Wis., and first introduced in one of the districts of the city of Paris, France, during the present year, where its great utility and practical success are fully demonstrated.

List of other papers.

THE following papers were also read in this section: Building associations, by *Edgar Frisby*; and Health foods, by *T. S. Haight*.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Hyperelliptic functions.—M. E. Wiltheiss starts out from a memoir of Prof. Kronecker's which appeared in the *Monatsberichte* of the Berlin academy for the year 1866, in which a method was developed for obtaining the parameters τ_{ik} of those theta-functions, which, for a certain definite transformation, remain unaltered. Prof. Kronecker started out from a purely algebraical stand-point, and solved the equations which connect the original and the transformed parameters τ_{ik} and τ'_{ik} . Corresponding to the transformation of the theta-functions, there is a transformation referring to the integrals belonging to these functions. Noting this fact, the author of the present paper has arrived at these singular values of the τ_{ik} in another manner, and his results bring into evidence a certain property which is analogous to the complex multiplication of elliptic functions. The author confines his attention solely to the theta-functions of two variables. — (*Math. ann.*, xxi.) T. C. [214]

Curvature of surfaces.—M. Rud. Sturm has given here a very interesting theorem analogous to Gauss' well-known theorem concerning the measure of curvature at a point on a surface. Gauss' theorem, stated briefly, is, that if a curve p enclosing an area F is drawn around a point P of a surface, and if a corresponding curve p' enclosing an area F' is traced out on a sphere of radius unity by the extremities of radii drawn parallel to the normals to the given surface at each point of p , then the limit value of the ratios of F' and F will be equal to the inverse product of the radii of curvature R_1, R_2 , of the given surface in the point P . M. Sturm's theorem is, that if the curve p is cut out of the given surface by a sphere whose centre is at P , then the mean curvature,

viz., $\frac{1}{2} \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$, is equal to the limit value of the ratios of the two perimeters p and p' . — (*Math. ann.*, xxi.) T. C. [215]

ENGINEERING.

Pressure on valves.—Professor S. W. Robinson presented to the American society of mechanical engineers, at its meeting in New York, November, 1882, a paper on the theoretical and the experimental determinations of the mean pressure on steam-valves exposed to pressure both above and below. He finds that a line can be determined, circumscribing an area which he calls the equilibrium area of the valve. This area being multiplied by the maximum pressure gives the total mean pressure acting to hold the valve to its seat. The extent of this area is determined by experiment; and a theory of the case is constructed, which is given at length, with the practical formulas derived by means of it for use in designing. — (*Van Nostrand's mag.*, July.) R. H. T. [216]

The performance of the Worthington pumping-engine.—Messrs. Shedd and Ward present to the water-commissioners of the city of Buffalo a report upon the performance of a Worthington pumping-engine, recently built for the city. The delivery was 28.8% greater than was demanded under the contract with the makers, amounting to above 19,000,000 gallons per day; and the 'duty' was something above 70,000,000 pounds of water raised one foot high per thousand pounds of steam used. This was above the duty demanded by the city. — (*Ibid.*) R. H. T. [217]

CHEMISTRY.

(Organic.)

Reconversion of nitro-glycerine into glycerine.—Great difficulty having been experienced in destroying the dynamite recently captured in England, Prof. C. L. Bloxam has tried several methods for decomposing its nitro-glycerine constituent. 1. Nitro-glycerine was shaken with methylated alcohol, and the solution was mixed with an alcoholic solution of KHS. Considerable rise in temperature resulted, the liquid became red, a large quantity of sulphur separated, and the nitro-glycerine was entirely decomposed. 2. Nitro-glycerine was shaken with a strong aqueous solution of commercial K_2S . The same changes were observed as in 1; but the rise in temperature was not so great, and the liquid became opaque very suddenly when the decomposition was completed. 3. The ordinary yellow solution of ammonium sulphide was mixed with the nitro-glycerine, and the mixture evaporated to dryness on the steam-bath, when bubbles of gas were evolved, due to the decomposition of the ammonium nitrite. The pasty mass was treated with alcohol to extract the glycerine. 4. Calcium sulphide, made by boiling flowers of sulphur with slaked lime, was used. Reduction took place as above, but more slowly, and more agitation was required. This last is the cheapest process. — (*Chem. news*, April 13.)

The reducing action of alkaline sulphides on nitro-glycerine was pointed out some time since, and A. H. Elliott, F.C.S., showed in the *School of mines quarterly*, Sept. 15, 1882, that the method admitted of quantitative application. — C. E. M. [218]

METALLURGY.

Water-gas as a fuel.—Mr. W. A. Goodyear believes that the fuel of the future in cities, for all domestic as well as for most manufacturing and metallurgical purposes, will be gas of some kind. The ease and cheapness of its distribution, the cleanliness and economy of its use, will, in his opinion, cause at no distant day a revolution in the present use of fuel. As a contribution to that end, he describes an apparatus of his own devising for the manufacture of water-gas, by means of which, he claims, this gas can be made in any desired quantity; and, while leaving a handsome profit to the manufacturers, it can be supplied at a cost that will render its general use more economical than that of any kind of solid fuel. — (*Trans. Amer. inst. min. eng.*, Boston meeting.) M. E. W. [219]

The recovery of the volatile constituents of coal.—The attention at present paid to the utilization of products heretofore wasted is well illustrated in an account of the Jameson process of coking coal, given before the London society of arts, April 26. The coking-ovens of England are estimated to have a capacity of some 20,000,000 tons a year; and only a slight and inexpensive alteration in the plant would, it is said, recover oil and ammonia to the value of \$16,000,000, and good heating-gas to the value of \$12,500,000. From the experiments of Sir J. B. Lawes, it has been estimated, that, if all the ammonia from all the raw coal burned in England were utilized in agriculture, 250,000,000 'dollars' worth of bread-stuff would be added to the yearly produce. The use of raw coal is characterized as a relic of barbarism. — (*Iron*, May 4.) R. H. R. [220]

GEOLOGY.

Stratified drift in Delaware.—F. D. Chester describes the relations of the gneissic rocks of Delaware, with their rolling, hilly, and local soils, to the unconformably overlying cretaceous clays extending to the south-east, with stratified gravels derived from the gneiss. These gravels and similarly derived deposits extend even over the top of Polly Drummond's hill, the highest land in the state, two hundred and fifty feet above the cretaceous plain, and three hundred and thirty feet above the sea. Large dolerite boulders of undetermined origin, sometimes twenty-five feet in circumference, lie on this hill; and a little farther south there are two hills of unstratified detritus and boulders, which are thought to have been dropped from ice floating in the sea, that deposited the stratified gravels during the submergence of the Champlain period. As the highest point in Delaware was then covered, this measure gives a minimum value of three hundred and thirty feet for the submergence. — (*Amer. journ. sc.*, xxv. 1883, 436.) W. M. D. [221]

Meteorites.

Concretions in meteoric iron.—Professor J. Lawrence Smith gives a connected statement regarding the concretions found from time to time in the interior of various meteoric irons. Six kinds

of simple nodules occur, composed respectively of pyrrhotite (troilite), schreibersite, graphite, daubréelite, chromite, and lawrencite. Others consist of several minerals aggregated together. Smith holds, from the study of these concretions, that the containing 'iron was at one time in a plastic state from the effect of heat.'—(*Amer. journ. sc.*, June.) M. E. W. [222

MINERALOGY.

Scovillite.—Under this name, Messrs. G. J. Brush and S. L. Penfield have described a new phosphate from the Scoville ore-bed, Salisbury, Conn. It occurs as a thin crust of a pinkish or brownish color, coating iron and manganese ores. Hardness, 3.5; specific gravity, 4. Before the blowpipe the mineral is infusible, and, with borax and salt of phosphorus, gives beautiful rose-colored beads (didymium) in both oxidizing and reducing flames. It is readily soluble in dilute acids. Chemical analysis yielded P_2O_5 (24.94). $(Y,Er)_2O_3$ (8.51). $(La,Di)_2O_3$ (55.17). Fe_2O_3 (0.25). H_2O (7.37). CO_2 (3.59) = 99.83 %. The presence of carbon di-oxide is regarded as due to an admixture of lanthanite, — $(La,Di)_2(CO_3)_3 \cdot 9H_2O$; and, deducting the constituents corresponding to the above formula, there is left 82.79 % of a phosphate, which, calculated up to 100 %, gives P_2O_5 (30.12). $(Y,Er)_2O_3$ (10.28). $(La,Di)_2O_3$ (55.75). Fe_2O_3 (0.30). H_2O (3.57) = 100 %. This corresponds closely with the formula $R_2(PO_4)_2 \cdot H_2O$, where $R = (Y, Er, La, and Di)$. The new mineral is therefore a normal phosphate of the above metals, plus one molecule of water.—(*Amer. journ. sc.*, June.) S. L. P. [223

Ullmannite.—Crystals of this mineral from Montanarba, Sardinia, have been crystallographically investigated by C. Klein. The crystals were embedded in calcite, and were obtained by dissolving the calcite in dilute acetic acid: they were of cubical habit, possessed a perfect cubical cleavage, and showed on the cubic faces the striations so common in pyrite, and characteristic of the parallel or pyritohedral hemihedrons. Besides the cube, the faces of the rhombic dodecahedron and pentagonal dodecahedron, $\pi \infty O_2$, were observed. The chemical analysis was made by P. Jannasch, and yielded S (14.02). Sb (57.43). As (trace). Ni (27.82). Co (0.65). Fe (0.03) = 99.95 %, corresponding closely with the formula Ni Sb S. Gravity, 6.84. The mineral is therefore closely related to pyrite, crystallizing like it in parallel hemihedrons, and having an analogous composition in that the nickel and antimony are isomorphous with iron and sulphur.—(*Jahrb. min.*, 1883, 180.) S. L. P. [224

GEOGRAPHY.

(Africa.)

French missionary-work in eastern Africa.—The French missionaries sent from Algeria have successfully established a station at Tabora in charge of Père Hautcoeur. Their missions at Ujiji and Usanzé are progressing favorably. That at Uganda, owing chiefly to the petty persecution experienced from king M'tesa, has been abandoned, and the party have taken refuge on the southern shores of Lake Tanganyika. Six new missionaries have been de-

spatched from Algiers to re-enforce the staff at stations in Central Africa. The station at M'rogoro, less than six months old, already presents the aspect of civilization, stone buildings replacing thatched huts; and the adjacent land, until lately covered with forests and jungle, has been cleared, and planted with coffee-bushes, which appear likely to succeed. Other establishments are equally flourishing.—(*Comptes rendus soc. géogr.*, no. 11.) W. H. D. [225

BOTANY.

Protogyny of grasses.—Bailey gives as an example, *Spartina juncea*.—(*Bull. Torrey club, July.*) W. T. [226

Pollination of prickly pear.—Dr. Kunzé sees, in the irritable stamens of *Opuntia vulgaris*, a provision for securing close fertilization by insect aid. In fair weather each flower opens on two successive days. Hive-bees, flies, and humble-bees were seen to visit the flowers for nectar, in obtaining which they grasp clusters of stamens, which, when released, fly up against the pistil, from which they slowly recede to their former position. Although the legs of the insects were covered with masses of pollen after visiting a flower, they were not seen to creep over the stigmas: *ergo*, the pollen grains are supposed to be thrown between the stigmas after the sudden movement following the retreat of an insect. It is hardly necessary to add, however, that crossing is well effected by the insects in question, the motion of the stamens insuring a thorough dusting of their bodies with pollen.—(*Bull. Torrey club, July.*) W. T. [227

Mimicry.—Bailey notes the resemblance of a spider to the involucre scales of the swamp thistle, on which it lies in wait for insects which visit the flowers.—(*Bot. gazette, Aug.*) W. T. [228

ZOOLOGY.

Mollusks.

Pleurotomidae of Senegambia.—Baron von Maltzan reviews the Pleurotomidae of this region, especially of the Island of Goree. He obtained thirty-six species and varieties, of which about one-third are new. Only four were known to Adanson, who first monographed this fauna. About fifteen per cent are European forms, which are smaller and rarer than those of the same species in the Mediterranean.—(*Jahrb. mal. ges.*, vii. ii.) W. H. D. [229

Mollusca of the Caucasus.—Böttger offers an important paper on the land-shells of the Caucasus, supplementary to others printed in preceding years. Rich material has been brought together by Gen. Komaroff and Hans Leder. The Limacidae afford several new forms: the new section *Gigantolimax* is proposed under *Amalia*, and *Paralimax* under *Limax*. A new genus of Testacellidae, *Selenochlamys*, is proposed for a form resembling *Daudebardia* externally, but without an internal shell, and with the respiratory orifice at the right anterior part of the very small clypeus. No known mollusk closely resembles this remarkable slug, which was found

near Kutais. A large number of new species and varieties are described. — (*Jahrb. mal. ges.*, vii. ii.) W. H. D. [230]

Monograph of Ringicula. — L. Morlet has published a second supplement to his valuable monograph of Ringicula, in which four new recent and as many new fossil forms are made known, and a synopsis, after Seguenza, of the tertiary Italian species, is added. — (*Journ. de conchyl.*, xxii. 3.) W. H. D. [231]

Worms.

New worm with remarkable nervous system.

— The Willem Barents on her third voyage captured a worm, which A. A. W. Hubrecht describes under the name of *Pseudonematon nervosum*. He gives a general account of its structure, and promises a fuller monograph. The animal is about sixty-five millimetres long, one and three-quarters millimetres thick, tapering behind. The digestive tract runs straight through from end to end. On the ventral side, about forty-five millimetres from the head, is a disk, probably a sucker. No traces of sexual, excretory, or sensory organs were found. The epidermis is thin. The muscles form three layers, — a thick external longitudinal, a middle transverse or circular, and an internal longitudinal layer, — variously developed in different parts of the body. The nervous system is very remarkable: it forms a continuous layer completely around the body, and lies immediately inside the layer of circular muscular fibres. It consists, 1°, of a fine network of delicate filaments, appearing as if felted, barely tinged by the staining reagents; and, 2°, of scattered nuclei belonging partly to connective tissue, partly to ganglion-cells. The layer forms a continuous tube from the head, where there is no ganglionic enlargement, back through the body to the caudal region, where the layer is present dorsally only.

Hubrecht further discusses the phylogeny of the nervous system in continuation of his previous paper (*Quart. journ. micr. sc.*, xx. 431). He points out, that, 1°, in its lowest form (*Medusae*), the nervous system is diffuse, and there are no nerve-fibres properly so called; 2°, in a little more advanced stage it tends to form a layer spread out under and parallel with the ectoderm; the general histological character is the same as under 1°, — a felted network of fine fibrillae, which spring from the ganglion-cells (*Actiniae*, *Pseudonematon*); 3°, the diffuse layer is still present, but certain tracts are more developed, making the primitive nerve-cords (*Chaetognathi*, *Cliton*, etc.); 4°, the diffuse part is gradually lost, and the cords are retained. These conclusions are confirmed by citations from numerous recent researches. Dr. Hubrecht has, we think, successfully established two very important generalizations, — first, that in the lower animals there prevails a uniform type of nervous tissue, ganglion-cell and nerve-fibre being incompletely differentiated, and the nerve-fibres being in the form of a network; secondly, that the nerves were developed by concentration of the diffuse tissue along certain pathways. His paper is certainly one of much value and originality. Systematically the

position of *Pseudonematon* is uncertain, but it probably belongs somewhere near the nematods and plathelminths. — (*Verh. acad. wetensch. Amst.*, xxii. 3d art.) C. S. M. [232]

VERTEBRATES.

Development of the diaphragm and pericardium. — Our knowledge of the changes which lead to the partitioning-off of the anterior end of the body-cavity in vertebrates to form the pericardial and pleural cavities has heretofore remained obscure. Uskow has investigated the subject under Waldeyer's direction, at Strassburg, and publishes an important memoir. The essay opens with a review of the previous literature. The research was carried out principally on rabbits, but also extended to other mammalia, and classes of vertebrates. At nine days (in rabbit embryos) the omphalo-mesaraic veins enter the body from the sides, along the lower wall of the body-cavity, into which they bulge up. The part of the body-cavity in front is cylindrical; behind, fissure-like. The two cylindrical halves meet anteriorly, and unite below the heart, forming the primitive pericardial division of the coelom. The posterior wall of this cavity is pierced by the sinus venosus, and receives the name of septum transversum: it is a thin membrane, which separates the pericardial space from the fore-gut of the embryo. In the next stage, the pericardial space has enlarged, the most important effect of which is to drive the septum transversum backwards until it lies together with the omphalo-mesaraic veins, so producing the membrane which supports the great veins, and divides off the ventral portion of the pericardial space from the dorsal portion and the general body-cavity, or paired coelom. This membrane then forms part of the wall of the pericardial cavity; but it also forms the primitive diaphragm, the dorsal portion of the original pericardial space becoming, in conjunction with the anterior end of the coelom, the pleural cavity.

The pericardial wall consists, according to its development, of three parts: 1°. part of the original wall of the coelom (this includes that portion which remains permanently attached in mammals to the anterior thoracic wall); 2°. the septum transversum, which becomes the pleuro-pericardiac membrane; 3°. the principal part derived from the body-wall, its separation being consequent upon the enlargement of the pleural cavities. The part from the septum is originally continuous with the diaphragm.

The diaphragm is at first a connective tissue structure. The muscle grows in later from the dorsal side, appearing first in embryos (rabbits) of nine millimetres length. It probably is derived from the muscle plates, but that was not determined with certainty. The primitive diaphragm arises in its ventral part from a papillary growth of the septum transversum; in its dorsal part, laterally from the tissue carrying the large omphalo-mesaraic veins; medianly, from the outgrowth of the septum transversum known as the *masa transversa*.

From the comparative study of other types, the following grades of development of the diaphragm

were ascertained. 1. The ventral and dorsal portions of the diaphragm are completely developed: they completely divide the coelom, and have muscles. The pericardium, except two thin lamellae, is entirely separated from the diaphragm (rabbit). 2. Same as 1, save that a part of the diaphragm remains united with the pericardium (man). 3. Same as 2, but the diaphragm contains no muscles, and its ventral part is completely fused with the pericardium (hen). 4. Same as 3, but the dorsal part is not completely developed, remaining in a primitive condition (lizard) or in an early stage (frog). Here might properly be reckoned certain imperfect developments in man. 5. Same as 4, but the diaphragm, or its ventral part, forms a united whole with the pericardium, remaining at the stage of the septum transversum (Myxinoïds, — *Ammocoetes*). 6. The teleosts stand apart, in that, although, as seen in the salmon, there is a certain separation of the diaphragm from the pericardium, even more than in birds, yet the dorsal portion of the diaphragm is completely wanting.

The paper contains numerous details. The author's nomenclature is confusing, and we have found it very difficult to follow his account. — (*Arch. mikr. anat.*, xxii. 143.) C. S. M. [233]

ANTHROPOLOGY.

Mutilations of the teeth.—Ethnographers who have minutely described mutilations of the teeth in other parts of the world have said nothing of a similar practice among the natives of the two Americas. The practice is not common in the western world; and it is a little singular that people who deform to an extraordinary degree their lips, noses, cheeks, and ears, respect the integrity of their teeth. The historians of this practice overlook the abrasions noticed by Vancouver among the Indians of Trinidad Bay, and by Petitot among the Tchiglit at the mouth of the Mackenzie and of the Anderson. Finally, no notice is taken of dental mutilations formerly in use in Mexico and Yucatan, upon which Sahagun, Landa, and Mota Padilla have furnished information. M. Hamy has gathered from the last-named writers their allusions to these subjects, and prepared an illustrated monograph. The drawings indicate both filing and perforations. — (*Bull. soc. anthrop. Paris*, v. 879.) J. W. P. [234]

Imperial Chinese tombs.—Among the mountains east of Peking are the imperial tombs. The Great Wall forms the northern boundary of an enclosure five miles square. Besides this, a wide tract outside the boundary-wall belongs to the mausolea, and is forbidden ground, wherein man is not permitted to build dwellings or to bury his dead. Shun-chih (1644–62) and four of his successors sleep here, with the heavens, the hills, and the streams around them. The earlier Manchu princes are buried at Movkden. The tombs are all alike in essential features, built on a southern slope, with a stream in front. In approaching the tomb, the explorer passes first two lofty stone pillars, that serve as a gateway to figures of men and animals in pairs, facing one another on

opposite sides. An ornamental archway opens upon a curved marble bridge of several arches, with finely carved balustrade. After crossing the stream, the traveller passes guard-houses and the sacrificial hall on the right and left, and comes upon a small building, in the centre of which stands, supported upon the back of a huge marble tortoise, the memorial tablet, on which is written an account of the deeds of the departed. Halls of entertainment flank this building; and farther on in a direct line are the chapel of the dead, the bright pavilion, and, last of all, the earth-palace, or tumulus, within which the coffin lies. When the body is laid in this earth-palace, the door is shut. Behind the door, inside, is a round hole in the stone floor; and, when the door is shut, a large ball of stone follows it, and, falling into the hole, prevents the stone door ever opening again. The emperor is then said 'to be at peace forevermore.' Mr. F. S. A. Bourne, who gives the information above quoted, entered this enclosure with great difficulty. A minute account of the appearance and function of the two rows of sphinx-like figures adds much interest to the author's narrative. The mausoleum prepared for the present empress's regent is just completed, and cost about £1,500,000. — (*Proc. roy. geogr. soc.*, v. 23.) J. W. P. [235]

EARLY INSTITUTIONS.

Malagasy place-names.—We have a long article upon local names in Madagascar by the Rev. James Sibree, jun. The object of the writer is to show how the names of places illustrate the mental habits of the people and their powers of observation. Many names of villages include Malagasy equivalents for the Anglo-Saxon words *tun*, *ham*, *burgh*. Personal names are very common. Villages are named after distinguished chiefs. The article will interest some of our readers. — (*Journ. roy. asiat. soc.*, April, 1883.) D. W. R. [236]

Chinese laws and customs.—An article upon this subject by E. H. Parker appeared in the *China review*, viii. 67. Now we have another by Christopher Gardner. The two writers are of one mind upon most points. It is only upon a few matters of detail that they differ. Mr. Gardner tells us that the laws and customs of China have been very little changed since the seventh century. Chinese law, we are told, cannot be 'squared' with the theory of Bentham and Austin, which resolves all laws into commands imposed by a lawgiver. It is based upon public sentiment and opinion, and upon previously existing custom. It 'follows the instincts of the people.' Then we are told that the tribe has been derived from the family, not the family from the tribe. Exogamy has in China prevailed over endogamy. As for the land, it is held by single families (house communities), or by groups of families (village communities). It is a pity that the writer does not describe the house community and village community more fully, and in more exact language. The article is interesting. — (*Journ. roy. asiat. soc.*, April, 1883.) D. W. R. [237]

NOTES AND NEWS.

WITH this number our report of the meeting of the American association is completed. No session of section G was held, and no vice-presidential addresses delivered in sections C, D, or G. In our next number we shall print in full the promised papers of Messrs. Carhart and Dana. At some future time we may also take occasion to refer more particularly to the report of the committee upon the removal of duties on imported text-books and the discussion of the same, of which we have a full account. Few other committees besides this, and those already announced, made any reports; and the several committees on weights, measures, and coinage, on standard time, on primary meridian and international standard time, and on the records of science, were discontinued, that on standard time in consequence of the favorable action of the railways of the country in the proper direction. The committee on the introduction of science teaching in the public schools, on the registration of deaths, births, and marriages, on stellar charts, and on an international convention of scientific associations, reported progress, and were continued.

A by-law to the constitution was passed, providing that every member should have the privilege of registering the members of his family at meetings of the association (not including men over twenty-one years of age), by paying three dollars for each registration; the person so registered being entitled to all privileges offered members by the local committee. The standing committee also passed a rule that hereafter no paper will be accepted for reading before any of the sections, unless accompanied by such abstract as the writer deems ready for publication.

Sections H and I had, in some respects, a similar experience at Minneapolis. Both were unable to organize until the week of the meeting was half over. To each there came, almost at the very last moment, a paper of unusual interest. In the anthropological section, Miss Babbitt's paper announced the discovery, in Minnesota, of traces of human labor beneath a deposit of twelve or fifteen feet of the material which forms one of the terraces of an ancient river. This seems to be a confirmation of the theory advanced by Dr. Abbott, respecting his similar discoveries in New Jersey, that man existed on this continent during at least a portion of the glacial epoch. There will, of course, be a lively discussion between experts, as to whether these quartz specimens are actual relics of human industry. Thus far, at best, the glacial workman is known only by his chips.

In the section devoted to statistics, Mr. Dodge announced what may perhaps be accounted a discovery in that dry branch of science. He has found that a singular and quite definite relation exists, in large communities, between an excess of non-agricultural over agricultural workers, and an increase of values in the land, products, and wages of agriculture. The figures may soothe the fears of those political economists who from time to time predict national disaster

because so few American youths take kindly to farming pursuits. An obvious inference from the statistics is that prosperity comes where industry is diversified. Weapons of argument may thence be drawn by those who believe in a public policy tending to encourage non-agricultural industries.

— The Royal academy of medicine of Turin has unanimously awarded the Riberi prize of 20,000 francs (\$4,000) to Prof. Bizzozero for his researches on the 'Physiopathology of blood,' the subject proposed by the academy. The commissioners of award received several essays: those of Wharton Jones, Norris, Hayem, and Bizzozero were considered to deserve special consideration. The last two were assigned the first rank. The most important matter in both of these is the investigation of the third morphological element of the blood (Hayem's haematoblasts). The commissioners, all well-known *savants*, judged that Hayem did not completely demonstrate that the red globules are derived from the haematoblasts. Bizzozero solves the important problem of the origin of the red globules, determines the relation of the haematoblasts to coagulation, and throws new light on the formation of thrombi. His memoir was therefore deemed the more important, and to Bizzozero accordingly the very valuable award has been made.

— The officers of the Cincinnati society of natural history inaugurated about June 1 a course of free lectures on botany. The first was given on June 9, to a company of forty-seven, many of them teachers in the public schools. The lectures have been continued weekly, and the last was given on Aug. 11. The object of the society in the establishment of this course was to get the public generally interested in scientific pursuits; and the success of this, the first attempt of the kind in this city for many years, has been most gratifying. The average attendance has been over thirty, notwithstanding the hot weather, lateness of the season, and the absence from the city of many who would otherwise have attended. The officers hope, in the autumn, to have courses in other branches of science, so that a general interest may be awakened among the citizens, and attention called to the importance of the study.

— News has been received from the French meteorological station at Orange Harbor, Patagonia: all were in good health, and work progressing favorably. The cattle which had been brought from Montevideo had perished, but those from Punta Arenas were flourishing. The surgeon of the party, Dr. Hyades, had made full anthropological investigations of the Fuegians who were settled near the station. Casts of heads and limbs had been secured, and many photographs taken. A collection of utensils, etc., had been brought together, including a large canoe with its entire outfit. He was engaged in studying the language, which appeared to be somewhat different from the vocabularies collected by Darwin nearly half a century ago.

— Professor W. A. Rogers wishes us to state that the relation between the imperial yard and the *mètre des archives* is wrongly given in our abstract of his

paper on p. 250. It should have been stated as follows: Imperial yard + 3.37027 inches = *mètre des archives*.

—Matthew Arnold's ingenious argument for the survival of literature, from its relation to conduct, encounters an objection in the apparent effect of scientific pursuits upon the character of his countrymen. When one affirmed of Clerk Maxwell, that "he was free from every taint of the world, the flesh, and the devil," it seemed no exaggeration to those who knew him. Darwin, Balfour, Sir Rowan Hamilton, and H. J. S. Smith, each in his turn was scarcely less endeared by his genial virtues than admired for his lofty powers. None of these was so largely identified with the world, its business temptations, its social allurements, as William Spottiswoode, the late president of the Royal Society; and none left the memory of a purer life, a heart more "full of exercised humanity."

In his funeral sermon, referring to the text, "The world passeth away, and the lust thereof; but he that doeth the will of the Lord abideth forever," the Dean of Westminster Abbey said, "Apart from general considerations of life and death, the words have special reference to that last one of our own time accounted worthy to rest with the illustrious dead within these walls. . . . To his great talents and his profound knowledge were united such graces of character as the most modest unselfishness and the most spotless integrity. He was ever anxious, earnestly and justly, to place before his fellow-men such knowledge as would conduce to their welfare; and so well did he do this work among his countrymen, that it might be doubted whether his philanthropy did not predominate over his love of science."

—M. Pasteur has proved that the burial of diseased animals does not destroy the germs of disease, or obviate the chance of infection to any animals who may afterwards feed on the ground above where the body of the diseased animal was buried. M. Aimé Girard proposes to destroy the germs in the dead bodies of diseased animals by treating the carcasses with cold concentrated sulphuric acid. The destruction of the germs is proved to be complete. Experiments made at St. Gobain show that three hundred and twenty-one kilograms at 60° proof, dissolved in ten days nine sheep, weighing two hundred and four kilograms. The resulting liquid, mixed with four hundred and forty kilograms of coprolites from Ardennes, produced nine hundred and forty kilograms of superphosphate of lime, containing thirty-six per cent of nitrogen. Thus, by a simple process, most dangerous bodies are destroyed, and a valuable fertilizer obtained.

—*Nature* announces that the Lords of the committee of council on education, of England, have, by a recent minute, decided to withdraw the prizes hitherto given to candidates in the science examinations who obtain a first class in the elementary stage of the various subjects of science, substituting certificates of merit, and retaining only the prizes given in the advanced stage. The money hitherto devoted to prizes will be employed in providing thirty-six

national scholarships, — twelve each year, — which will be offered in competition to students of the industrial classes, and awarded at the annual examinations of the department. The National scholarship will be tenable, at the option of the holder, either at the Normal school of science, South Kensington, or at the Royal college of science, Dublin, during the course for the associateship, — about three years. The scholar will receive thirty shillings a week during the session of nearly nine months in the year, second-class railway fare to and from London or Dublin, and free admission to the lectures and laboratories. This is a most important step in advance.

—The Rev. Father Émile Fortuné Stanislas Joseph Petitot, well known for his valuable contributions to American linguistics and his extended journeys over the Hudson Bay territory, has received a medal from the Royal geographical society. He is the first Frenchman thus honored since Francis Garnier. He has now retired from mission-work, and will devote himself to study for some years.

—The Delaland-Guerineau prize has for the second time been bestowed by the French academy upon M. Savorgnan de Brazza, of Congo notoriety. The military medal for 'exceptional services' has been given to the sergeant Malamine, a native of Senegal, for his defence of Brazzaville against all comers during the absence of his superior.

—The last number of the bulletin of Nuttall club contains part of Burrows' list of birds from the lower Uruguay, which is sufficiently full to be of value. The critical list of birds in vicinity of Colorado Springs is of great interest. Mr. Allen's valuable list of minor ornithological publications should also be mentioned.

—Mr. E. H. Miller states, in the *American agriculturist*, that wherever the ornamental shrub commonly called *Deutzia scabra* grows near grape-vines, the rose-bugs prefer the flowers of the *Deutzia*, and thus the grapes are protected. Grape-growers may therefore cultivate a charming shrub with a double purpose.

—Rev. W. W. Meech recommends, in the *American agriculturist*, judicious salting to prevent the blight which troubles quinces, and burning affected parts to overcome the ravages of the fungus *Roestelia aurantiaca*.

—The sixth annual report on the birds of Germany in the *Journal für ornithologie* contains many interesting notes on migrations and breeding-dates.

—At a lecture recently given at Mauch Chunk, Penn., by Mr. Charles A. Ashburner, geologist in charge of the anthracite surveys in that state, the lecturer made some general statements in regard to the amount of coal which has been mined, and which still remains in the region, which we copy from the *Mining herald* of Shenandoah. "The total amount of coal produced from the anthracite fields up to Jan. 1, 1883, was 509,333,695 tons. It is hard to realize this amount. To place it in a popular form, it was stated that it would form a solid compact wall of coal (25 cubic feet = 2,240 pounds = 1 ton) 100 feet wide and 100 feet high for a distance of 241 miles, or it

would form a similar wall along the railroad between Philadelphia and New York 100 feet wide and 268 feet high. It was estimated that the region originally contained 25,000,000,000 tons. If it be assumed that in the production of 509,333,695 tons an area has been practically exhausted which originally contained 1,500,000,000 tons, there is 94% of the coal originally contained which still remains untouched. In comparing the anthracite region with the bituminous fields of England, the estimated contents of the former is about one-sixth of what the most recent estimates assign to the latter. About the same proportion exists between the annual production of Pennsylvania anthracite and English bituminous. Mr. Ashburner stated the estimates were based upon very general, but at present the most reliable data. The geological-survey estimates have not yet extended beyond the Panther Creek basin, between Mauch Chunk and Tamaqua. It was stated that this basin originally contained 1,032,000,000 tons of coal,—double the amount which has already been shipped from the entire region. An area had been mined over in this basin, up to last January, which originally contained about 92,000,000 tons, so that 91% of the original coal still remains untouched. About 88% of the coal which has been mined from this basin was taken from the mammoth bed."

In a subsequent communication to the same paper, Mr. Ashburner disclaims having made any statements with regard to the exhaustion of the anthracite coal-fields of Pennsylvania, with which he had been credited by various newspapers. He adds, however, that Mr. P. W. Shearer, who has probably given this subject more careful consideration than any one else, has made a very general statement that the field still contains about 25,000,000,000 tons of coal. Up to Jan. 1, 1883, he had estimated that the total production amounted to 509,333,695 tons. It has been generally thought that but one-third of the coal contained has been consumed as fuel; so that, up to last January, an area had been exhausted which originally contained about 1,500,000,000 tons, 23,500,000,000 tons remaining untouched. If this same proportion of production to original content be applied to that which still remains, about 8,000,000,000 tons would represent the possible future production. According to the mine-inspector's report, there was produced last year 31,281,066 tons. If this production should remain constant for all future time, the field would be exhausted in a little over 250 years. Such a conclusion is quite untenable, for our yearly production is rapidly increasing. In 1870 there was shipped from the region 16,182,191 tons, and in 1880, 23,437,242 tons. The abrupt exhaustion of the coal-fields is a practical impossibility; nor is it reasonable to suppose, that, if on an average for every ton of coal won there are two lost, this will be the practice in future mining. The geological survey has already in its possession many valuable facts to throw light on this subject; but, as it is hoped that the survey will be completed before this question of ultimate exhaustion will become one of practical concern, it would be folly to make any statement as to how long the coal will last.

—M. Daubr  e has been examining an interesting meteorite which fell not far from Nogoya, in the province of Entre R  os, Argentine Republic. Chemical analysis proves that the meteorite contains iron, lime, and magnesia; but its most important feature is, that it is said to contain carbon in an organic form, which is chiefly proved by the action of potash in it. M. Daubr  e from this is led to hope that he may yet find organic remains in a meteorite.

—In the September *Atlantic*, Bradford Torrey prints some studies in the temperaments of birds, which will interest ornithologists, as they are made from personal observation. The chickadee, goldfinch, brown thrush, towhee, blue-jay, shrike, white-eyed vireo, and chat, and the New-England species of *Hylocichlae*, are discussed.

—The Florence newspapers announce the acquisition of a skull of *Mastodon arvernensis* by the Istituto di studi superiori. Professor d'Ancona writes to *La nazione*, that it was found through excavations that were making in pliocene deposits in the neighborhood of Percussina, situated about two hundred metres above the sea, between Siena and Florence.

—In his recent work on cultivated plants, DeCandolle says, "In the history of cultivated plants I have found no indication of communications between the inhabitants of the old and new world anterior to the discovery of America by Columbus. The Gulf Stream has equally been without effect. Between America and Asia, two transportations may have been effected; one by man (the batatas), the other by man or by the sea (cocoa-nut)." Drs. Gray and Trumbull, in commenting on this in the last number of the *American journal of science*, say, "Perhaps the banana should be ranked with the sweet-potato in this regard. And we may merely conjecture that the purslain came to our eastern coast with the Scandinavians or the Basques."

—Ostrich-chicks are hatching out at the ostrich-farm near Anaheim, Cal., at the rate of one a day. When they first come out of the egg, they are about the size of a half-grown duck. They have good appetites, and grow rapidly.

—Means of transportation are rapidly increasing on the borders of countries not within the recognized bounds of civilization. Thus it is announced that the journey from Paris to Algiers will shortly be reduced to thirty-three hours rail and steamer travel, of which only sixteen will be by boat. Hitherto passengers by the Marseilles line, in the regular routine of travel, have spent forty hours on the water alone, beside the railway journey from Paris.

—At the meeting of the French entomological society, held July 11, Mr. E. Lef  vre showed a large solitary ant allied to *Ponera*, found about Hong Kong, remarkable for the extraordinary development of its mouth parts, and for its power of leaping; being able, when disturbed, to make bounds of twenty to twenty-five centimetres. The statement was confirmed by the experience of earlier observers. As the legs are in no way developed for springing, Mr. Lef  vre was inclined to think that it was accomplished in some way by its buccal organs.